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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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South American Business

The farther one removes one's vista from the great manufacturing centres the better is the appreciation obtained of the conditions of international business. This thought was provoked by studying the exceedingly intelligent Report* on the Economic Conditions in the Argentine Republic written by Mr. Stanley G. Irving, C.M.G., the British Commercial Attaché in Buenos Aires. Before we point out some facts which ought to be appreciated by British manufacturers, we would stress the desirability of the employers' federations taking steps to see that recommendations are placed before their management committees for taking appropriate actions to safeguard British interests. Taking the raw materials of the foundry industry, we are told that English coke, on account of quality, has held its own against German competition, even though the latter is of good quality and suitable size. In the case of pig-iron, Russian is selling at 11s. below the English price and 7s. below the Saar level; moreover, Mr. Irving states that the Russian quality quoted "is said to be superior to low-grade United Kingdom and French pig-iron. As a sidelight on international economics the following paragraph dealing with radiators and their accessories is illuminating and affords food for thought by enlightened employers' federations."

"The trade in steam radiators and accessories is monopolised by an American company which controls factories in Germany, Belgium, Holland, France and the United Kingdom, and allots orders to whichever factory is in the best position to supply. In the past twelve months the local agents of this company are said to have obtained orders to a value approximating $650,000 pesos paper. The greater part of these orders went to Germany. The amount mentioned represents approximately 50 per cent. of the total consumption. A large proportion of the remaining 50 per cent. is of national manufacture. As radiators are now being successfully manufactured in the country, it will probably not be long before the imported article is ousted from the market."

A paragraph dealing with cast-iron cookers also is worthy of quotation, as indicating the necessity for co-operative action. It reads "Importation is now limited to a few accredited types sold under names which are still specified by the consumers. The high customs duties, which exceed in some cases the f.o.b. value of the article, and latterly the depreciation of the peso, have given a sharp impetus to local production. Several firms in Buenos Aires have recently begun to manufacture cast-iron cookers, including those with porcelain-enamel finish, copying the imported articles in all respects except quality. Despite its manifest inferiority, the local product is being offered at such low prices that, unless conditions unexpectedly change, the import market for solid-fuel cookers will continue to be very difficult."

The same conditions apply to cast-iron stoves, where again accredited imported marks, unless patented, have been copied and the imitations sold at a cheap rate. Competition is also being made in gas cookers and a local company has doubled its sales as from 1933 to 1935. In general, the Report is of great interest to the foundry industry, as other sections deal with agricultural implements, machine tools, automobiles and cast-iron pipes and fittings.

* Price 4s. 6d. net from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2.

The Influence of the Machine

Lest any reader might be tempted to take seriously as a solution to economic difficulties the abolition of the machine, apparently contemplated in Italian agriculture, as mentioned in our last issue, we think it necessary to stress the fact that such a policy is little more than a policy of despair. The suggestion that the Chinese abolished the machine may quite well be true, for they are a remarkable race with a very ancient civilisation, but we have only to compare their position to-day with that of their Eastern rivals, Japan, to see how much their policy has cost. We do not know how much better off the average Chinese is than the average Japanese. The difference may well be small, for we have good reason to know the extent of the white man's burden and the price of empire, and the Chinese may well be able to live a leisured and contemplative existence more truly in line with their desires than the Japanese. But we feel confident that the average Briton would not change his mode of life for that of the inhabitant of any other country, and we have no desire to be forced into such a position that we have to ask the permission of other nations to continue to exist. What we really need is not less machinery, but more. The machine has emancipated us from

(*Concluded on page* 2)

XUM

Hints to Intending Examination Candidates

BY City and Guilds Finalist

Those students who intend to sit for one or other of the City and Guilds Institute Examinations in Patternmaking, held annually, will, no doubt, be well versed in their facts and figures. Therefore, it is not so much with those that these hints are concerned, as with the details attached to an examination, that the student often overlooks.

One point emerging from the results of casual inquiry from a number of examinees, both past and intending, is the absence of prior familiarity with the Syllabus issued by the examining body in question, a desideratum which, to the writer's mind, should be a fundamental requirement of every intending examinee. This information is given, along with other helpful suggestions, in the syllabus aforementioned.

A fair knowledge of the principles of mechanical drawing is demanded by this examining body, particularly in the final examination, judging from the perusal of the last few years' Papers, and also from the syllabus. It is worthy of note that in a recent report on one of the City and Guilds drawing examinations the examiners deplored the lack of knowledge displayed by the candidates *of the usually-accepted conventions of drawing*. In this respect students are advised to acquaint themselves with the British Standard Institute's Specification No. 308—1927, "Engineering Drawing-Office Practice," obtainable through many technical colleges, etc., at half the price otherwise demanded for this publication. This favours "first angle projection" as the recognised practice of this country. Amongst other useful matters dealt with are:—Cross-hatching, writing, dimensioning, abbreviations for drawings, types of lines, views and sections, etc. Here might be added a note on the correct insertion of arrow-heads; nothing mars the appearance of a drawing so much as large, black, untidy arrow-heads; a little time spent in practising the making of small neat ones will be amply repaid by the enhanced appearance obtained through their use.

Sketches of some methods of making a pattern and corebox, or of some patternmaking tool or machine, are certain to be called for. Now, whilst one may be able to picture the object called for in the mind's eye quite clearly, one will not find it quite so easy to set it down on paper. The best method of approaching this problem is to sketch lightly two or three different views of the object and then select the one that appears to convey most information for setting down in answer to the question. Much practice is needed to become proficient in the art of rapid sketching, but it is of great help to notice the minor details of machines and tools, etc., in the workshop, and to note particularly the proportions of the various parts, for it is in this respect that many an otherwise satisfactory sketch fails to attain the required standard.

When sketching patterns and coreboxes, the student should be particular to show the direction of the grain of the wood, as this conveys the vital information as to whether he is familiar with the best mode of construction. He should remember also when drawing one half of a corebox to show his method of setting the two halves in true relationship to each other, that is, by pegs and cups or dowels, or any other means.

If in answer to any question the student shows a knowledge of the latest methods and ideas he will be almost certain to gain a few extra marks. In this connection the hint given in the aforementioned City and Guilds syllabus *re* the reading of THE FOUNDRY TRADE JOURNAL each week, is well worthy of the utmost consideration.

A study of the examination papers of recent years will serve to show on what lines these examinations are held. These can be obtained for a nominal charge from the Institute; with the aid of these one can test one's knowledge in the light of previous examinations.

The student must never guess haphazardly at an answer as he will thereby betray his lack of knowledge; if one says that Exeter is in Lancashire, then it shows an ignorance of the geography of both Lancashire and Devon, but if, however, the question is unanswered the conclusion is that the geography of Devon only is unknown.

If there be six question to answer, all of equal value, it is inadvisable to spend too much time on any one; the student will stand a much better chance if he does six questions in a general way than if he specialises on three. In the latter case, even if he scores full marks for each question he will only obtain 50 per cent., whereas he will obtain this amount from six questions if he only obtains half marks for each, so the student should keep his eye on the clock and allocate so much time to each question, then pass on to the next.

Then, of course, there is the rule about getting to the room about fifteen minutes prior to the time of commencement of the examination. This gives the student choice of seats and plenty of time in which to set out his belongings. The hints about neatness, conciseness and the use of correct English should be faithfully observed.

It is advisable to take a plentiful supply of pencils of various grades, some sharpened to a chisel and some to a round point. For those who are taking their own drawing board it will be found useful to plane the left-hand and bottom edges up at right-angles; by this means long vertical lines can be drawn with the tee-square, thus saving time in having to move the tee-square and set-square down the board two or three times to complete a long vertical line. This, it is admitted, is wrong in actual practice, but in an examination the candidate is out to beat the clock and thus legitimate artifices such as this can be profitably resorted to even though they are contrary to definitely-accepted practice.

If the student is a member of the Institute of British Foundrymen he will be eligible for the silver medal which they offer for the member with the highest marks, so "go ahead and make the best use of your time and material."

Notes from the Branches

Scottish Branch.—A large number—about 120—of the members of the Scottish Branch of the Institute of British Foundrymen accepted the invitation of Messrs. James Howden & Company, Limited, to visit their foundry and engineering departments at the Scotland Street Works, Glasgow, recently. The party were received by Mr. H. Hurst, foundry manager and Branch-President, and at once proceeded to the foundry where the 5-ton Brackelsberg furnace was in operation. The members witnessed the melting and casting of a charge for high-class engineering castings. After the foundry had been inspected the party visited the fan, fitting, general engineering and erecting shops under the guidance of Mr. Hurst, Mr. T. Young and assistants. At the conclusion of the visit, Mr. Daniel Sharpe, Branch-President-Elect, proposed votes of thanks to the directors of the firm for having extended the invitation to the members and to Mr. Hurst and the assistants, who had done so much to make the visit interesting and profitable. He voiced the general opinion of the members present in saying that the Brackelsberg furnace presented an interesting and, he thought, valuable departure in foundry melting plant for high-grade castings.

THE TELEPHONE NUMBER of the London Iron and Steel Exchange has been changed to Central 3417.

Catalogues Received

Combustion Steam Raising. For the average foundrymen only the last three pages of a very smart brochure, issued by International Combustion, Limited, Aldwych House, Aldwych, London, W.C.2, will interest him, as the first ten pages are devoted to steam raising. But since so many foundries have now introduced pulverised coal as a fuel for firing rotary melting furnaces and annealing ovens, he will be interested to learn something of grinding and crushing, feeders and burners. Perhaps some day the foundryman may be favoured with a catalogue specially designed for his attention.

Stellite. It appears, from a very interesting booklet issued by the Deloro Smelting & Refining Company, of 21, Hubert Street, Aston, Birmingham, that there are now four grades of Stellite. This alloy—or rather series of alloys—is, it will be remembered, compounded from cobalt, chromium and tungsten carbides. Of the four grades only No. 40 is used as a cutting tool. No. 4 is also a sort of welding rod for depositing a hard surface on to metals; No. 10 is somewhat similar, but less hard and more resistant to chemical attack; whilst the last one, No. 12, is used in connection with dry batteries. It will be readily realised that the potentialities it offers, in combination with the oxy-actylene flame, are very considerable, and the fifty odd pages devoted to this subject are well worth study. It is somewhat surprising to find no reference to sand-blast nozzles in the sections dealing with hard-face alloying.

Steel. Amongst clever attempts made to sell steel by catalogue, one recently issued by Samuel Fox & Company, Limited, of Stocksbridge (Branch of United Steel Companies, Limited), must indeed rank high. This particular pamphlet carries the caption "An Ideal Achieved in Steel." By incisive and brilliant letterpress, helped by splendid photography, the reader is told how a few years ago an ideal was conceived to manufacture steel by the cleanest process ever invented—that of the high-frequency-electric furnace—and to associate with this a system of inspection to which the coined phase "diamet inspected" was given. D.I.A.M.E.T. means "disc inspected and metallurgically examined and tested." Discs are continuously taken for macro etching, and a very strict metallurgical control is imposed right through all the various processes. The brochure runs to 28 pages, and worthily upholds the extremely high reputation enjoyed by the publicity matter emanating from the United Steel Companies.

The Influence of the Machine

(*Concluded from page* 1)

toil and we have only to proceed on the path we have already travelled so far for the situation to right itself. Through the machine we have shorter working hours, more leisure, and more time to think. It is true that for the moment the enormously increased productivity, consequent largely on the war period, has left a hard core of unemployment due to the smaller current demand, but if the improvement in working conditions and shortening of hours continue as in the past, and as far as international conditions permit the problem will be capable of solution. Even now, if our leisure activities could be properly organised, the very demand for material and apparatus to serve leisure activities would reduce the unemployed by a fair proportion. It is doing nothing that is demoralising. It may suit political dictators to encourage a reversion to manual toil, but there is no virtue in labour that can be avoided, particularly if its avoidance, through the machine, can provide time and energy for more interesting pursuits.

INSTITUTE OF BRITISH FOUNDRYMEN

THIRTY-SECOND ANNUAL CONFERENCE AT SHEFFIELD

The thirty-second Annual Conference of the Institute of British Foundrymen, which is being held in Sheffield this week under the Presidency of Mr. J. E. Hurst, opened on Tuesday, July 2. The arrangements in connection with the Conference were made by the Sheffield Branch and Mr. T. Makemson, the General Secretary of the Institute.

In addition to the conducting of the formal business of the Institute and the meetings for the consideration of technical Papers, arrangements have been made for visits to various large works in the Sheffield area. Special visits to a number of industrial establishments are included in the programme for the ladies participating in the Conference.

On Wednesday visits were made to the following works:—Steel, Peech & Tozer, Limited, The Ickles, near Sheffield (large modern open-hearth steelmaking plant and high-capacity rolling mills); Hadfields, Limited, Tinsley, Sheffield (large steel foundries and engineering shops); Sheepbridge-Stokes Centrifugal Castings Company, Limited, Sheepbridge (centrifugally-cast cylinders, liners, etc., in ordinary and alloy irons); and the Foundry Department of the University of Sheffield (melting, moulding and other equipment used in Foundry Degree Course). To-day members have the choice of visiting:—The English Steel Corporation, Limited, Grimesthorpe, and Vickers Works, Sheffield (steel foundry, new open-hearth and heavy-forge departments, and heavy-machine shops); Newton, Chambers & Company, Limited, Thorncliffe Works, Chapeltown (blast furnaces, jobbing and specialised iron foundries); General Refractories, Limited, Worksop (modern refractories plant, manufacture of bricks for all purposes); and the United Steel Companies' research laboratories, and high-frequency induction furnaces of Samuel Fox & Company, Limited, Stocksbridge (up-to-date research department and modern melting unit of large induction furnaces for manufacture of special steels). Descriptions of these works will be found in this and last week's issues of THE FOUNDRY TRADE JOURNAL.

Yesterday and to-day the ladies visited the following establishments:—Arthur Davy & Sons, Limited (modern food factory); Walker & Hall, Limited (manufacture of cutlery, electroplate, silver goods); City Hall and Central Library; Painted Fabrics, Limited (fancy goods made by disabled soldiers and sailors); Wm. Gunstone & Sons, Limited (manufacture of biscuits); and the "Sheffield Telegraph" (modern printing works).

On the last day of the Conference, Friday, July 5, the members and their ladies are taking part in an all-day excursion into Derbyshire by motor-coach. A garden party is being held at the Rising Sun Hotel, Hope, by the kind invitation of the President and Mrs. J. E. Hurst.

ANNUAL GENERAL MEETING

The Annual General Meeting of the Institute was held in the Mappin Hall, St. George's Square, on Tuesday evening, with the retiring President, Mr. Roy Stubbs, in the chair.

The minutes of the preceding annual general meeting were taken as read, and were confirmed and signed.

The Annual Report of the Council for the session 1934-35 was presented.

ANNUAL REPORT

This report covers the twelve months ended April 30, 1935, and the accounts are for the year ended December 31, 1934.

Membership

An examination of the membership figures shows that 181 new members were added during the year, while, on the hand, the names of 233 members were removed from the roll, showing a net loss of 52. This reduction is partly due to the trade conditions which prevailed during the years 1931 and 1932, which are usually reflected in the membership of this Institute a few years afterwards, but the principal cause of the reduction in figures is due to the very drastic revision of the register which has taken place. The great majority of the present membership of 1,780 can be considered as really active members who maintain their interest and continue their subscriptions. This assumption is borne out by an examination of the financial statement, which shows that in spite of reduction in membership, there has been practically no reduction in the income from subscriptions.

Table I shows the changes in membership, and an analysis of the present membership is given in Table II.

J. E. HURST

(President of the Institute of British Foundrymen).

MR. J. E. HURST is a director of Messrs. Bradley & Foster, Limited, Darlaston, and the Technical Director of Messrs. Sheepbridge Stokes Centrifugal Castings Company, Limited. He has been intimately associated with the development of the centrifugal casting process in Great Britain, particularly in its application to special cast irons for high-duty purposes. In 1918 and 1919 he was Editor of THE FOUNDRY TRADE JOURNAL. He has made numerous and original contributions to the Iron and Steel Institute, of which he is a member and a Carnegie Research Scholar, and also to various other societies and technical bodies. In 1932 he was awarded the Oliver Stubbs Gold Medal in recognition of his outstanding contributions to the metallurgy of cast iron, particularly in the form of new alloys. For some years Mr. Hurst has conducted extensive research into the possibilities of hardening and tempering various cast irons and alloy cast irons. Results of some of his investigations have been presented to the Institute of British Foundrymen in a series of Papers commencing in 1930. Mr. Hurst is also a member of the Council of the British Cast Iron Research Association and a member of the Staffordshire Iron and Steel Institute.

TABLE I.—*Changes of Membership.*

	Subscribing firms.	Members.	Associate members.	Associates.	Total.
At April 30, 1934..	50	744	934	104	1,832
Additions and transfers from other grades ..	3	63	95	20	181
	53	807	1,029	124	2,013
Losses and transfers to other grades	4	78	128	23	233
At April 30, 1935..	49	729	901	101	1,780

Honorary Members

Sir Wm. J. Larke, K.B.E., and Mr. S. G. Smith, have been elected Honorary Members for their services to the industry and to the Institute in particular.

Honours Conferred upon Members

Among the honours which have been conferred upon members of the Institute, are the following:—

The Rt. Hon. Arthur Henderson, M.P., has been awarded the Nobel Peace Prize.

Dr. W. H. Hatfield has been elected a Fellow of the Royal Society, and also Vice-President of the Iron and Steel Institute.

Sir H. C. H. Carpenter has been elected President of the Iron and Steel Institute.

Sir Wm. J. Larke, K.B.E., has been elected Vice-President of the Iron and Steel Institute.

Mr. H. Winterton, Junior Vice-President, has been appointed a Bailie of the Burgh of Milngavie.

Deaths

It is with regret that the Council reports the deaths of ten members.

TABLE II.—*Analysis of Membership, April* 30, 1935.

Branch.	Subscribing firms.		Members.		Associate members.		Associates.		Total.	
Birmingham	3	(2)	108	(106)	117	(114)	14	(17)	242	(239)
East Midlands	3	(3)	44	(46)	85	(79)	3	(3)	135	(131)
Lancashire	15	(15)	119	(121)	228	(240)	27	(24)	389	(400)
London	5	(6)	147	(147)	73	(80)	8	(7)	233	(240)
Middlesbrough			21	(25)	38	(38)	7	(5)	66	(68)
Newcastle	6	(6)	28	(35)	26	(36)	21	(29)	81	(106)
Scottish	5	(6)	86	(87)	180	(173)	11	(10)	282	(276)
Sheffield	6	(6)	81	(84)	60	(70)	5	(7)	152	(167)
Wales and Monmouth ..	2	(2)	30	(26)	28	(33)	3		63	(61)
West Riding of Yorkshire	3	(3)	38	(35)	62	(60)	1	(1)	104	(99)
Unattached	1	(1)	27	(32)	4	(11)	1	(1)	33	(45)
	49	(50)	729	(744)	901	(934)	101	(104)	1,780	(1,832)

The three Associates attached to the Wales and Monmouth Branch are Student Associates.

Finance

The Balance Sheet and Income and Expenditure Account, are given on page 5. It will be noted that there was an excess of income over expenditure of £208 14s. 5d., which is the largest credit balance to be reported for some years. This is due to economical working in all directions, particularly on the part of the Branches, to whom thanks are due for the reduction in their expenditure which has been achieved without diminishing their efficiency. The cash at the bank, £509 4s., includes a sum of £69 4s. 11d., which has been transferred from the surplus funds in the hands of the Branches.

Although the finances are in a very satisfactory condition, the Council is conscious of the importance of closely scrutinising every item of expenditure, and a Special Sub-Committee is at present reviewing every aspect of this matter.

Technical Committee

The Technical Committee and its Sub-Committees continue to carry out valuable work in reviewing technical developments in every branch of the industry. The detailed report of the work of the Technical Committee is included in this booklet.

Manchester Conference

The Thirty-first Annual Conference was held in Manchester, from June 5 to 8, 1934. The Lord Mayor of Manchester opened the Conference on Wednesday, June 6, and with the Lady Mayoress was present at the Annual Banquet on the evening of the same day.

At the Opening Meeting of the Conference, Mr. Roy Stubbs was installed President in succession to Mr. C. E. Williams.

The Council tenders its sincere thanks to the Lord Mayor of Manchester and the Lady Mayoress, and to all those firms who arranged visits for members and ladies to their works; to the staffs of those firms; to the authors of Papers; to those who subscribed to the funds and to all who assisted in any way in the organisation of this very successful Conference.

The thanks and congratulations of the Council are specially tendered to the members and ladies of the Lancashire Branch who were responsible for the organisation, and particularly to the Branch President, Mr. W. N. Cook; to the Chairman of the Conference Committee, Mr. A. Phillips; to Mr. J. E. Cooke, the Conference Secretary, and Mrs. J. E. Cooke, Secretary of the Ladies' Committee.

Presentation of Badges

At the Manchester Conference, the members of the Lancashire Branch presented to the Institute, a gold badge of office for the use of the President, at official functions, and the ladies of the Lancashire Branch presented a similar badge for the use of the President's wife. Mr. and Mrs. C. E. Williams also presented an official badge for the use of the Vice-President. The Council tenders its grateful thanks for these valuable gifts.

Mr. C. E. Williams

The Council wishes to acknowledge its indebtedness to Mr. C. E. Williams whose term of office as President terminated at the Manchester Conference, and also to Mrs. Williams. The Council has decided to commemorate Mr. Williams' year of office by establishing the Edward Williams Lecture, which will be given annually at future Conferences. The first lecture will be delivered at Sheffield on Wednesday, July 3, 1935, by Sir Wm. J. Larke, K.B.E.

Mr. Williams' own Branch, the Wales and Monmouth Branch, also showed their appreciation of his services and those of Mrs. Williams, by entertaining them to a complimentary Dinner in December last.

Other Technical Organisations

The Institute has maintained and strengthened its relations with other technical organisations. It is now represented through its Technical Committee, on most of the important B.S.I. Committees which are of interest to the foundry trade, and keeps in close contact with other technical bodies in the engineering industry.

Along with other similar organisations, the Institute co-operated with the Iron and Steel Institute in the Symposium on Welding, which was held in London recently.

British Cast Iron Research Association

The Annual Report of the British Cast Iron Research Association for the year ending June, 1934, showed that the income was the highest ever recorded in its history, the drop in Government grant which took place in 1932 as a consequence of the depression having been more than made good from industrial sources, H.M. Government has offered for the current year to increase the grant by £2,000 provided an additional £1,000 is secured from industry, and the support of eligible non-members is invited to enable this to be achieved. The Government offer also provides for further increase in grant as the industrial income increases in a way which makes it possible to reach before 1940 a total income of £20,000 per annum. In line with this expansion, the Research Programme has been enlarged, the staff increased and work which should be of the highest interest and importance to the industry is progressing.

Invitations

Messrs. F. W. Bridges & Sons, Limited, have invited the Council to luncheon, and the whole of the members to tea at the Shipping, Engineering and Machinery Exhibition to be held at Olympia, in September. They have also placed at the disposal of the Institute, a stand in the Foundry Section of the Exhibition. The Technical Committee has undertaken the responsibility of utilising this stand to show recent progress in foundry practice, and to indicate the share which the Institute has taken in that progress. The Birmingham Chamber of Commerce has also invited the members of the Council to luncheon at the British Industries Fair at Birmingham, on May 29.

Overseas Foundry Associations

Ten members and ladies attended the International Foundry Conference which was held in Philadelphia in October, and took part in a pre-Conference tour of some of the principal cities in the United States. During this tour they were enabled, by the courtesy of our American friends, to visit some of the most important foundry plants in America, and make contact with a large number of important American foundrymen.

A meeting of the International Committee of Foundry Technical Associations was held in Philadelphia during the Conference, and was attended by Mr. James Smith and Mr. T. Makemson, as representatives of the Institute, and also by Mr. V. Delport in his capacity as European representative of the American Foundrymen's Association.

An International Foundry Conference will be held in Brussels from September 20 to 25. Arrangements are now being made to organise a party of members and ladies to attend this Conference, in response to an invitation received from the Belgian Foundrymen's Association.

The author of the official Exchange Paper to the International Conference in Philadelphia was Dr. W. H. Hatfield. Mr. E. Longden was the author of the Exchange Paper given to the French Foundry Conference at Nancy in July. Exchange Papers will be presented on behalf of the Institute at forthcoming Conferences as follow:—American Foundrymen's Association, Toronto—Mr. A. J. Murphy; International Foundry Conference, Brussels—Mr. H. H. Beeny; French Foundry Conference, Paris—Mr. P. A. Russell. At our own Conference, to be held in Sheffield in July next, Papers will be presented on behalf of the American, French and German Foundry Technical Associations.

Branch Activities

Perhaps the most important of the Institute's activities centre round the Branches. During the year under review, meetings have been held regularly in about twenty cities and towns; nearly 100 Papers have been presented at Branch meetings in addition to several general discussions and the Branch-Presidents' addresses.

The Institute is deeply indebted to the Branch officials for their devoted work, and also to the authors of Branch Papers, and firms with whom they are associated. In November last, an important new departure took place in London in the form of a two-days' joint meeting with the London and East Midlands Branch.

Educational Activities

The Degree Course in Founding at the University of Sheffield, to which reference has been made in previous reports, was established in the autumn of 1934 and is now in operation. The Institute has been responsible for much of the preliminary work in connection with the establishment of the Course, and through our instrumentality a number of firms have pledged themselves to support the scheme financially for a period of seven years. A number of donations have also been given, and the members of the Institute have themselves subscribed the sum of £50 13s. as a donation towards the expenses of the Course.

Much progress has already been made in connection with the establishment of the intensive course in Foundry Practice designed for persons already engaged in the foundry industry, which is to be established at the Birmingham Central Technical College under the auspices of the British Cast Iron Research Association.

The examinations in Foundry Practice and in Patternmaking conducted by the City and Guilds of London Institute, are being held as this report is being prepared. The results are not yet available; the following figures, however, show the results of the 1934 examinations.

	No. of candidates.	Pass 1st class.	Pass 2nd class.	Percentage of passes.
Patternmaking— Intermediate grade	26	5	10	57.7
Patternmaking— Final grade ..	19	5	9	73.7
Foundry Practice and Science ..	45	9	20	64.4

Prizes were awarded as follow:—PATTERNMAKING, Intermediate Grade—Mr. G. V. Dipple, of Coventry, Bronze Medal; PATTERNMAKING, Final Grade—Mr. W. G. Humpheson, of Wolverhampton, Silver Medal and Buchanan Prize of the Institute of British Foundrymen, Mr. S. A. Horton, Derby, Buchanan Silver Medal of the Institute of British Foundrymen, and Mr. J. S. Ferguson, Glasgow, Buchanan Prize; FOUNDRY PRACTICE AND SCIENCE—Mr. L. G. Boulton, of Wednesbury, Bronze Medal and Buchanan Prize of the Institute of British Foundrymen, and Mr. W. Brindley, Wolverhampton, Buchanan Prize.

National Certificates

Thirty-two National Certificates in Mechanical Engineering with special reference to foundry work, were endorsed by the President of the Institute, making a total of 103 since the commencement of the endorsement of these certificates which are issued jointly by the Institution of Mechanical Engineers and the Board of Education.

In the autumn of 1934, the new Trade School was opened by the Education Committee of the City of Glasgow. The Scottish Branch of the Institute has been largely responsible for the organisation of the foundry and patternmaking sections of this school. Mr. A. Campion, Past-President of the Branch, has rendered important work in this connection, and the classes in these subjects are under the general control of Mr. J. Longden, Past-President of the Branch.

Awards

The following awards were made by the Institute during the year:—

THE OLIVER STUBBS MEDAL. The thirteenth award was made in June, 1934, to Mr. V. C. Faulkner, Past-President, "for his work in connection with the establishment of the Degree Course in Founding at the University of Sheffield."

MERITORIOUS SERVICES MEDAL. The second award of this medal was made in June, 1934, to Mr. J. J. McClelland, honorary secretary of the Wales and Monmouth Branch since its establishment, "as a recognition of his devoted service for many years."

DIPLOMAS. The announcement of the award of Diplomas for the year 1934 was made at the Manchester Conference. The names of the recipients and the Branches before which the Papers were given, are as follow:—

W. G. Morgan, Birmingham Branch.
F. Hudson, Lancashire and London Branches.
A. Logan, Lancashire Branch.
T. Makemson, London Branch.
G. L. Bailey, London Branch.
Dr. A. B. Everest, London Branch.
J. Longden, Scottish Branch.
J. Roxburgh, Sheffield Branch.
B. Gale, Wales and Monmouth Branch.

SURTEES MEMORIAL EXAMINATION. The 1935 examination was held by the Newcastle Branch. All the candidates entered in the Junior Section of the examination, and the results were of a very high standard.

Prizes were awarded as follow:—

Silver Medal, H. Vasey.
2nd Prize, J. Slater.
3rd Prize, F. W. Latimer.

In view of the very high standard, consolation prizes were also awarded to other candidates. The Governors of the Examination wish to acknowledge their indebtedness to the authorities of the Rutherford Technical College, Newcastle, for the excellent arrangements they made in connection with the examination.

Employment Bureau

The Employment Bureau continues to assist in making contact between employers and members who are in search of positions. The Institute continues to be indebted to the proprietors of THE FOUNDRY TRADE JOURNAL for the facilities which they have afforded. It is satisfactory to note that due to the improved trade conditions, a much smaller number of members are disengaged.

Bye-Laws and Rules

The certificate of His Majesty's Privy Council in respect of the revised Bye-Laws was given in October last. Copies of the Bye-Laws and Branch Rules which are now in operation have been circulated to all members.

Council

Four Council meetings and a large number of Committee meetings have been held at Manchester, Blackpool, Bradford and Glasgow. The average attendance was 40. There have also been several meetings of various special sub-committees. There have been eight meetings of the Technical Committee and Technical Council, and, additionally, over forty sub-committee meetings have been held. Of the ten members of the Council elected by ballot, five retire each year. The five who so retire at the annual general meeting on July 2 are:—Prof. J. H. Andrew, Messrs. V. Delport, J. R. Hyde, E. Longden and D. H. Wood. All these gentlemen offer themselves for re-election.

The Council again wishes to tender its thanks to Mr. W. B. Lake, J.P., honorary treasurer, for his valuable work in connection with the Institute's finances, the results of which are reflected in the improved financial position.

Sheffield Conference

The Thirty-second Annual Conference will be held at Sheffield from July 2 to 5, when Mr. J. E. Hurst, President-Elect, will be installed President of the Institute.

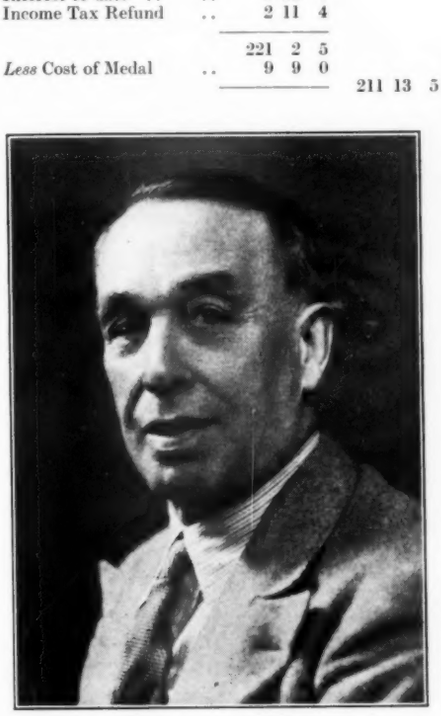
ROY STUBBS,
President.

TOM MAKEMSON,
Secretary.

BALANCE SHEET, DECEMBER 31, 1934.

LIABILITIES.

	£ s. d.	£ s. d.
Subscriptions paid in advance		123 18 0
Sundry Creditors		437 17 10
The Oliver Stubbs Medal Fund:—		
Balance from last Account	210 14 6	
Interest to date	7 16 7	
Income Tax Refund ..	2 11 4	
	221 2 5	
Less Cost of Medal ..	9 9 0	
		211 13 5
The Buchanan Medal Fund:—		
Balance from last Account	125 13 1	
Interest to date	4 14 9	
	130 7 10	
Less Cost of Medal and Prizes	7 15 7	
		122 12 3
Sheffield University Fund ..		46 9 0
International Conference Fund:—		
Surplus included in General Investments		40 18 11
Accumulated Fund:—		
Balance at December 31, 1933	1,488 17 11	
Add: Excess of Income over Expenditure for the year ended December 31, 1934	208 14 5	
		1,697 12 4
		£2,681 1 9



H. WINTERTON

(Senior Vice-President of the Institute of British Foundrymen).

MR. H. WINTERTON, who is chairman of Messrs. William Cumming & Company, Limited, of Glasgow, presided with distinction in 1929 over the Scottish Branch of the Institute of British Foundrymen, and was also at the same time President of the Foundry Equipment and Supplies Association. In 1933 he was President of the Refractories Association. In January of this year Mr. Winterton was elected a Bailie of Milngavie, Glasgow.

ASSETS.

	£ s. d.	£ s. d.
Cash in hand of Secretaries:—		
Lancashire	18 5 4	
Birmingham	31 16 6	
Scottish	15 18 5	
Sheffield	24 8 6	
London	54 3 5	
East Midlands	24 9 0	
West Riding of Yorkshire	15 4 9	
Wales and Monmouth ..	0 12 3	
Middlesbrough	8 14 6	
		193 12 8
General Secretary		9 17 6
Sundry Debtors:—		
Subscriptions due and subsequently received ..		122 17 0
Lloyds Bank Ltd.		509 4 0
Do. (Sheffield University Fund)		46 9 0
The Oliver Stubbs Medal Fund:—		
£342 5s. 7d. Local Loans £3 per cent. Stock at Cost	200 0 0	
Balance at Lloyds Bank Ltd.	11 13 5	
		211 13 5
The Buchanan Medal Fund:—		
£125, £3 10s. 0d. per cent. Conversion Stock at 78½	98 6 9	
Balance at Midland Bank	24 5 6	
		122 12 3
Investments Account:—		
£650 3½ per cent. War Loan at Cost	630 8 4	
£300 5 per cent. Conversion Stock, 1944–64, at Cost	297 14 11	
£653 19s. 0d. Local Loans 3 per cent. Stock at Cost	451 13 8	
		1,379 16 11
Furniture, Fittings, and Fixtures:—		
Per last Account	94 7 10	
Less: Depreciation 10 per cent.	9 8 10	
		84 19 0
		£2,681 1 9

W. B. LAKE, *Hon. Treasurer.*
TOM MAKEMSON, *Secretary.*

We have prepared and audited the above Balance Sheet with the Books and Vouchers of the Institute, and certify the same to be in accordance therewith.

J. & A. W. SULLY & CO., *Chartered Accountants, Auditors.*

19–21, Queen Victoria Street, London, E.C.4.
March 21, 1935.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED DECEMBER 31, 1934.

EXPENDITURE.

	£ s. d.	£ s. d.
Postages		107 18 9
Printing and Stationery, including printing of "Proceedings"		606 15 9
Council, Finance and Annual Meetings Expenses ..		80 19 4
Medal for Past President ..		3 0 0
Branch Expenses:—		
Lancashire	121 16 1	
Birmingham	68 3 6	
Scottish	88 6 7	
Sheffield	64 14 0	
London	45 10 5	
East Midlands	38 14 3	
Newcastle	37 2 1	
West Riding of Yorkshire	27 10 3	
Wales and Monmouth ..	29 1 6	
Middlesbrough	23 14 6	
		544 13 2
Audit Fee and Accountancy Charges ..		12 12 0
Incidental Expenses		60 6 8
Salaries—Secretary and Clerks		665 18 5
Rent, Rates, &c., of Office, *less* Received		90 4 4
Subscription International Committee ..		5 0 0
Depreciation of Furniture		9 8 10
John Surtees Memorial Examinations Grants to Branches		8 2 5
		2,194 19 8
Excess of Income over Expenditure carried to Balance Sheet		208 14 5
		£2,403 14 1

INCOME.

	£ s. d.	£ s. d.
Subscriptions received :—		
Lancashire		456 12 0
Birmingham		333 18 0
Scottish		360 18 6
Sheffield		225 15 0
London		374 18 10
East Midlands		151 14 6
Newcastle		86 2 0
West Riding of Yorkshire		124 8 6
Wales and Monmouth ..		87 3 0
Middlesbrough		86 12 6
Unattached Members ..		42 16 0
		2,330 18 10
Add : Subscriptions in Advance, 1933	97 2 6	
Do. due 1934 ..	122 17 0	
		219 19 6
		2,550 18 4
Less : Subscriptions in Advance, 1934	123 18 0	
Do. due 1933 ..	99 4 6	
		223 2 6
		2,327 15 10
Sale of " Proceedings," &c.		10 19 6
Interest on Investments and Cash on Deposit		51 16 1
Income Tax Refund ..		8 13 0
John Surtees Medal Fund, Surplus		3 2 6
Profit on Sale of Badges ..		1 7 2
		£2,403 14 1

The resolution for the adoption of the Report was proposed by the retiring PRESIDENT, who commented on the satisfactory progress which it reflected, and was seconded by MR. A. HARLEY (Past-President), who was also gratified by the fact that it showed considerable activity in all branches of the Institute's work. The Institute, he said, was in a flourishing condition, and the members had every reason to be satisfied.

The Report was adopted.

Finance

MR. W. B. LAKE, J.P. (hon. treasurer), proposing the adoption of the accounts, called attention to the fact that there was an excess of income over expenditure of more than £200. That result had been attained by economical working on the part of the Branches and close co-operation between the Branches and the General Council. He tendered his sincere thanks to the Branches for that co-operation. The General Council had decided, he added, to invest £300 in Government securities from the balance in hand; this was made possible by adopting the policy of not keeping balances in the hands of the Branches, but of transferring their surpluses to the General Fund.

MR. A. SUTCLIFFE suggested that the Branches were holding too much money.

MR. T. MAKEMSON (General Secretary) replied that the amounts of cash in the hands of the Branches, as shown in the accounts, were the amounts in hand on December 31, 1934. Those sums—less about £10 in each case—had since been paid into the General Fund, in accordance with the policy which had been adopted during the last four or five years—he believed since Mr. Sutcliffe himself had made the suggestion. The rule was that before the end of March of each year the Branches returned to General Fund the amounts they had in hand, less a working balance of £10.

The motion for the adoption of the balance sheet and accounts was carried.

Report of Technical Committee

MR. J. W. GARDOM (Convener of the Technical Committee) moved the adoption of the Committee's fourth Annual General Report. He expressed his personal appreciation of the help afforded him by the officers of the sub-committees and the members of the Technical Committee as a whole, who had devoted much time and work, and had gone to considerable expense in carrying on the work.

During the past year the Committee had achieved one thing which he had always hoped it would achieve, *i.e.*, closer co-operation with outside bodies, such as the British Standards Institution. In the past the Institute of British Foundrymen had been very well represented on the B.S.I.; but he had felt that there was no organisation by which they could keep in close touch with the feeling of the members of the Institute generally, except by writing or by personal contact. Nowadays, however, they could obtain through the Technical Committee an idea of what the Institute, as a whole, wanted to be done on the technical side.

MR. VICTOR STOBIE (Past-President), seconding the resolution for the adoption of the Technical Committee's Report, said the amount of work done was evidenced by the fact that more than 50 meetings had been held during the year, and the members of the Committee were making a really valuable contribution to the advancement of the industry.

The Report was adopted.

C. W. BIGG

(Junior Vice-President of the Institute of British Foundrymen).

MR. C. W. BIGG, who is assistant managing director and vice-chairman of Messrs. Qualcast, Limited, served his apprenticeship with Messrs. Brown & Green, Limited, of Luton, and obtained experience in various light-casting foundries. Eventually joining the Derwent Foundry Company, Limited, of Derby, he was placed in charge of the pattern department in 1913, and became successively foundry manager, works manager, and works director. When the Derwent Foundry Company, Limited, was reconstructed in 1928 and became Qualcast, Limited, he was appointed assistant managing director and vice-chairman. Mr. Bigg's membership of the Institute of British Foundrymen dates from 1915, when he joined the East Midlands Branch, of which he was President in 1932. In addition to his activities on several other committees, Mr. Bigg has been a member of the General Council since 1930.

FOURTH ANNUAL GENERAL REPORT OF THE TECHNICAL COMMITTEE

Since the publication of the last Annual Report, four meetings of the Technical Committee have been held at Carlisle (twice), Birmingham and London. Four meetings of the Technical Council have also been held at Manchester, Blackpool, Bradford and Glasgow. Meetings of all sub-committees have been held on the same dates as the meetings of the Technical Committee and numerous additional sub-committee meetings have been held also. The total number of meetings of the Technical Committee, Technical Council and sub-committees during the last twelve months is about fifty.

The Technical Council consists of members elected by the Branches and certain *ex-officio* members; the Technical Committee consists of the Technical Council with the addition of a number of members who are co-opted on various sub-committees by reason of their special knowledge and experience. These bodies form the necessary liaison between and give the necessary direction to the various sub-committees through which the bulk of the work is carried out. As will be seen from the attached detailed reports, the activities of these sub-committees cover almost every branch of foundry practice.

Sub-Committee Reports

In addition to their normal activities of investigation and correlation, sub-committees from time to time issue reports dealing with certain phases of their work. An exhaustive report by the Cast Iron Sub-Committee was presented to the Manchester Conference, and aroused considerable interest and discussion. During the winter session, this report was re-read at four Branches, on each occasion by a member of the Cast Iron Sub-Committee, and the committee is now engaged in classifying the various suggestions and criticisms made in the discussions before the branches, with a view to incorporating them in their future work.

An interim report on melting costs has been prepared by the Costing Sub-Committee with a view to stimulating discussion and criticism. This report was presented at six Branches during the winter. Very valuable suggestions were received during the ensuing discussions and these suggestions are being utilised by the committee. The practice of presenting such reports to the various Branches adds considerably to the labours of the sub-committees and of the members who present the report in various parts of the country, but the practice does bring the report to the individual notice of a large body of members of the Institute and enables the sub-committees concerned to avail themselves of a considerable volume of suggestions and criticism.

A report on tolerances of dimensions of malleable castings has been prepared by the Malleable Iron Sub-Committee, but has not yet been published. This report has opened up a very wide field, inasmuch as the subject is of importance in other branches of foundry practice in addition to malleable iron founding. The report is now being extended, in consultation with other sub-committees, so that eventually it will be a comprehensive report on the subject dealing with all types of castings.

General Activities

Apart from the work of the sub-committees, the Technical Committee, as a whole, is active in several directions which will ultimately be of benefit to members of the Institute, such general activities include representation of the Institute on committees of the British Standards Institution and other similar bodies. The Technical Committee is now the Institute's recognised medium for keeping in contact with such organisations, and by means of its representatives the Institute is in direct and continuous contact with the preparation and revision of specifications and other similar matters. Mr. P. A. Russell, Convener of the Cast Iron Sub-Committee, has been elected chairman of the B.S.I. Sub-Committee, M.E./35/2, Grey-Iron Castings.

Attention has been given to the question of investigating a suitable test for relative fluidity or " castability " of cast iron, steel and non-ferrous metals. Individual members of the committee have carried out exhaustive tests on various types of apparatus with a view to making recommendations in the near future.

Most investigators of foundry practice sooner or later find difficulty in the fact that many foundry terms have a purely local significance. Realising that some kind of standardisation of foundry terms is desirable, at least in their own work, the Committee is now endeavouring to collect lists of terms which vary in various parts of the country, with a view to recommending standard practice.

Foundry Exhibition

It will be remembered that at the International Foundry Exhibition held in London in April, 1933, the Technical Committee was enabled, through the courtesy of the organisers, to arrange a very successful technical exhibit. Another exhibition will be held in September next, at Olympia, in association with the Shipping, Engineering and Machinery Exhibition, and Messrs. F. W. Bridges & Sons, Limited, have kindly placed a stand at the disposal of the Institute for a similar exhibit. The Technical Committee has undertaken to be responsible for organising this exhibit.

The Inquiry Bureau, which was instituted in October, 1932, continues to perform useful service to members of the Institute. A large number of small inquiries have been dealt with, whilst a number of major inquiries have been answered, involving considerable preparation on the part of the various sub-committees and of individual members of those committees.

Members of the Institute are invited to avail themselves of the services of the Inquiry Bureau in connection with problems which they may encounter, or information which they may require. Correspondence should be addressed to the Secretary of the Institute.

On behalf of the Institute as a whole, the Convener wishes to acknowledge the valuable work which is done by the conveners of the sub-committees and by the individual members, and also the facilities which are granted by the firms with which the members of the committees are connected. Without such loyal and generous support the success of the Committee's work would be impossible. Members frequently travel long distances to attend meetings at their own expense, and on behalf of the Institute the Convener tenders his thanks to them and to all who have co-operated with them.

The Convener also wishes to express the Institute's thanks to the large number of firms who have co-operated with the Melting Furnaces Sub-Committee on the questionnaire on cupola linings and patching materials, and with the Costing Sub-Committee in connection with their work, and the firms who are co-operating with the Sands and Refractories Sub-Committee in supplying information and carrying out tests.

J. W. GARDOM,
Convener,
Technical Committee.

REPORTS OF SUB-COMMITTEES

Sub-Committee on Costing

Since the last Annual Report, the Costing Sub-Committee has held five meetings, at Luton, London, Leicester and Derby. A substantial amount of work has also been effected by correspondence.

A preliminary Paper on "Costs in the Melting Department of a Grey-Iron Foundry" was presented before the following Branches and Sections:—Birmingham, Derby, London, Glasgow, Sheffield, Lincoln. The Paper was also published in THE FOUNDRY TRADE JOURNAL (November 8, 1934). The discussions that followed the presentation of this Paper were most helpful, and, as a result, the Sub-Committee was enabled to draft definite recommendations relative to melting costs. These recommendations have not yet been published. The question of production costs in the moulding department is under consideration, and our investigations on that point are practically completed.

It is hoped that recommendations relative to costs in the core-making department and in the cleaning and finishing department will be ready before the end of the year. It is our intention to prepare a preliminary report on the whole subject of "Costs in a Grey-Iron Foundry," and it is suggested that this report be available for presentation before the various Branches during the present year. This preliminary report would also be available for the Glasgow Conference in 1936. It is hoped that the report may be published in due course in THE FOUNDRY TRADE JOURNAL.

Endeavours will be made to present the work of the Sub-Committee, in a condensed form, at the Foundry Exhibition, on the stand of the Technical Committee, next September. It is of interest to note that the discussions which followed the publication of the Paper on melting costs were of great assistance to the Sub-Committee, and it is hoped that similar discussions on production costs will take place. Since the last Annual Report, the Costing Sub-Committee has co-opted Mr. C. C. Booth, who has given valuable assistance from the standpoint of the jobbing foundry.

V. DELPORT,
Convener.

Sub-Committee on Melting Furnaces

The Sub-Committee has proceeded with the questionnaire on cupola-lining and patching materials, mentioned in the last report, and

T. R. WALKER, B.A.
(The Honorary Convention Secretary).

Mr. T. R. Walker is head of the Chemical Research Department of the English Steel Corporation, Limited.

details of some 50 cupolas are now available. The results of this inquiry have been tabulated, and the data will be made available very shortly. The Sub-Committee hopes to present a symposium of foundry melting furnaces at the next annual conference, with a view to providing data on modern melting practice. A start has been made on the collection of practical operating data for non-ferrous furnaces.

F. K. NEATH,
Convener.

Sub-Committee on Sands and Refractories

A year ago the Sub-Committee decided to issue a questionnaire on moulding-sand mixtures, for distribution to various foundries, hoping thereby to arouse an interest in sand testing, and enable the Committee to make practical tests on a number of different sand mixtures, also to enable the Sub-Committee to check the results on the sand-testing apparatus they have recommended. The work of issuing this questionnaire and dealing with the replies and samples sent in, has formed the bulk of the work carried out this session. Copies have been sent to all the Branches for distribution, with the following results up to date:—

Birmingham. Representatives: Messrs. A. Tipper, J. J. Sheehan, Dr. Skerl. Replies received, 5; tests completed, 4.

Lancashire, Sheffield, East Midlands, West Riding of Yorkshire. Representative: Mr. T. R. Walker. Replies received, 1; tests completed, 4.

Middlesbrough, Newcastle. Representatives: Messrs. N. D. Ridsdale and A. Logan. Replies received, 8; tests completed 4.

Scottish, Falkirk, Edinburgh. Representatives: Messrs. F. Hudson, A. Campion, W. Y. Buchanan. Replies received, 3; tests completed, 3.

London. Representative: Mr. H. H. Shepherd. Replies received, 4; tests completed, 4.

Wales and Monmouth. Representatives: Messrs. R. J. Richardson and B. Hird. Replies received, 1; tests completed, 1.

Total replies received, 22; total tests completed, 17.

The dry compression-strength testing apparatus designed by Mr. W. Y. Buchanan has been developed and tried out during the session, in co-operation with Mr. F. Hudson and other members of the Sub-Committee. They have obtained very satisfactory results and the Sub-Committee is now engaged in drawing up a specification for size of test-piece and time and temperature for drying. This type of apparatus has been accepted as standard for the time being by the Sub-Committee.

Fluidity tests with the spiral test-piece have been discussed, and tests carried out and reported on by our members.

BEN HIRD,
Convener.

Sub-Committee on Cast Iron

Since the presentation of the report to the Manchester Conference, this report has been re-discussed at meetings of four Branches, a member of the Sub-Committee summarising the report and replying to the discussion. The question of the soundness of castings is still before the Sub-Committee, but little further experimental work has yet been carried out.

The Sub-Committee has been principally concerned with the proposals for a higher specification for grey cast iron, and has made recommendations to the British Standards Institution for three grades of high-duty cast iron to be incorporated in a new specification. These recommendations have been accepted by the British Standards Institution as a basis for discussion, and this Sub-Committee is now actively engaged in the preparation of the necessary data for the tests. The question of bar sizes is also up for discussion by the British Standards Institution, and this Sub-Committee is considering its recommendations on this subject. In connection with the work on the B.S.I. Specifications, the Sub-Committee has obtained the co-operation of six additional members who are particularly equipped to deal with this matter, and is also working in close co-operation with the British Cast Iron Research Association.

The Sub-Committee has in the course of preparation a second series of typical microstructures illustrating various forms of cast iron not included in the first series; it is hoped that this will be available to members during the autumn of this year. The work on carbon pick-up has been held up owing to the pressure of other work upon the Sub-Committee. The Sub-Committee has co-operated with the Technical Committee and its Sub-Committees in various ways.

P. A. RUSSELL,
Convener.

Sub-Committee on Malleable Cast Iron

An investigation of the possibility of utilising a standard-sized bar, but specifying different test requirements to satisfy various sections of metal was carried out. The work has been brought to a conclusion so far as black-heart

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malleable cast iron is concerned, but it has been considered that additional tests should be made upon white-heart malleable so that this work is still in progress. Work on the correlation of the physical properties of malleable cast iron with micro-structures has been continued, but is still far from being completed.

The Sub-Committee has completed an investigation of the accuracy of castings to drawings and patterns obtained in normal practice, and has produced data illustrating the effect of many variable factors in moulding and casting. A report was presented to the Technical Committee and the matter has now been referred back to the Malleable Sub-Committee for the inclusion of additional data which are being supplied by the Sub-Committees on steel, non-ferrous and grey iron.

During the year the British Standards Institution has considered the revision of the malleable specifications and our Technical Committee has been represented on the appropriate B.S.I. Committee. The Malleable Sub-Committee from its past work has definite recommendations to put before the B.S.I. Some additional work is planned which, it is hoped, will result in useful guidance to the B.S.I. Committee in its work.

A. E. PEACE,
Convener.

Sub-Committee on Non-Ferrous Castings

This Sub-Committee now comprises ten members, both elected and co-opted, whose work in the past year has been most helpful. Since the third report, issued last year, attendances have been made at four sub-committee and four full technical committee meetings held in Manchester, London, Birmingham and Carlisle. The chief work undertaken has been the consideration and correlation of the tests obtained from various sources on the two leaded gun-metals and three leaded phosphor bronzes intended for recommendation to the British Standards Institution. Minor adjustments in the proposed composition ranges have been made and check tests instituted, but full agreement has not yet been reached in regard to the nature and values of the physical tests to be put forward. Further meetings and discussions are in progress.

J. S. G. PRIMROSE,
Convener.

Sub-Committee on Steel Castings

The Steel Sub-Committee has further investigated the valve casting, only two of which have to be completed. We have fortunately arranged for the testing of these castings to be conducted by a valve user, and hope to obtain a fair comparative report. Izod impact values are being investigated and are being discussed. We were able to assist the malleable general committee with particulars on tolerances on steel castings, and we are drafting out further details in this connection. During the coming Session we hope to complete our report on our findings in the valve investigation.

R. J. RICHARDSON,
Convener.

Oliver Stubbs Gold Medal

The RETIRING PRESIDENT reported that the Council had decided not to make an award of the Oliver Stubbs Medal this year.

Meritorious Service Medal

It was announced that a Meritorious Service Medal had been awarded to Mr. H. Bunting (who is retiring shortly from the office of hon. secretary of the East Midlands Branch).

Diplomas

It was announced that the General Council had awarded Diplomas, as follows, for Papers presented to the Branches during the past session:—

Mr. W. H. Bamford, for a Paper on "Cupola Practice, with a view to Closer Carbon Control," read before the Birmingham Branch.

Mr. P. A. Russell, for a Paper on "Some Experiences in the Manufacture of High-Grade and High-Duty Alloy Iron Castings," read at a joint meeting of the London and East Midland Branches.

Mr. W. Machin, for a Paper on "Castings." The Paper was presented jointly by Mr. Machin and Mr. M. C. Oldham, but Mr. Oldham is not a member of the Institute and the diploma is awarded to Mr. Machin.

Mr. T. Tyrie, for a Paper on "Defects in Iron Castings—their Cause and Cure," read before the Scottish Branch.

Mr. T. R. Walker, for a Paper on "The Testing of Steel-foundry Sands and the Control of Supplies by Specification," read before the Sheffield Branch.

Mr. J. Roxburgh, for a Paper on "The Technique of Chilling," read before the Sheffield Branch.

Election of President

The election of Mr. J. E. Hurst as the new President of the Institute was proposed by the retiring PRESIDENT and seconded by MR. C. E. WILLIAMS (Past-President). References were made to his international reputation as a metallurgist. Mr. Hurst was unanimously elected.

Vote of Thanks to Retiring President

A hearty vote of thanks was accorded Mr. Stubbs for his services to the Institute as President, and the hope was expressed that he would continue to give the Institute the benefit of his services in the future as in the past. Mrs. Stubbs was also thanked for her great assistance during the past year.

Election of Vice-Presidents

Mr. H. Winterton (Scottish Branch) was elected Senior Vice-President and Mr. C. W. Bigg (East Midlands Branch) was elected Junior Vice-President.

Auditors

Messrs. J. & A. W. Sully & Company (chartered accountants) were unanimously re-elected auditors for the coming year.

Members of Council

On Wednesday morning the result of the ballot for the election of members of Council was announced. The following were elected:—Elected for two years Prof. J. H. Andrew; Mr. V. Delport; Mr. E. Longden; Mr. P. A. Russell; Mr. D. H. Wood. Elected for one year—Mr. R. A. Miles. (Mr. Miles was elected in succession to Mr. E. Stevenson, who has resigned.)

Reception at the Town Hall

At a reception held on Tuesday night at the Town Hall, Sheffield, the guests were received by the Lord Mayor and Lady Mayoress (Alderman and Mrs. P. J. M. Turner) and by the President of the Institute (Mr. Roy Stubbs) and Mrs. Stubbs.

Sanbra, Limited

The list of subscriptions opened last week in connection with an issue by Sanbra, Limited, of 120,000 6 per cent. 10s. preference shares at par and 240,000 ordinary shares of 1s. each at 2s. per share. The company has been formed to acquire from Mr. P. N. Dingley as going concerns the undertakings and assets of (1) the Sanbra Engineering Company, Aston, Birmingham, engineers and brass founders, specialising in the manufacture of water, gas and sanitary fittings; (2) the Sandwell Casting Company, manufacturers of non-ferrous castings; (3) the Patent Copper Coupling Company; and (4) the Twigg Water Fittings Company, manufacturers of hot pressings for the motor, sanitary and general engineering trades.

Catalogues Received

White Pine. Two really very attractive photographs of white pines and a forest in winter form the outside covers of a cardboard folder issued by the Chetham Timber Company, Limited, of 70, Finsbury Pavement, London, E.C.2. The printed matter deals with Idaho white pine (*Pinus monticola*). This tree grows in dense forests with other tree species of lesser commercial value at elevations varying from 2,000 to 5,000 ft. above sea-level in Idaho. A full-grown tree at its best will attain a diameter of 5 ft. and often a height of over 200 ft. It is important, from the patternmaker's point of view, as it is claimed for this timber that the knots will dress smooth without leaving the grain around them. All the wood is free from heart centres.

Distant Indication and Control. We were recently surprised during a visit to a works to find, in discussion with a well-known foundry foreman, that he had constructed a large water reservoir to take care of surface water, and this had proved a real money-maker for his employers. Moreover, it was not his first excursion into civil engineering of this character. Thus a recent publication received from Messrs. Evershed & Vignoles, Limited, Acton Lane Works, Chiswick, London, W.4, bearing above caption, dealing with the necessary control of reservoirs may be of interest to quite a number of our readers. It is a 24-page pamphlet, beautifully illustrated and written in a very readable manner.

Electric Furnaces. Quite a number of improvements are discovered by overdoing good things. We remember some years ago examining an electric-furnace installation in Germany with Mr. W. B. Lake, and we criticised the water-cooling system as being excessive and expensive. Mr. Lake then related how, in his original electric furnace many years ago, he was getting very poor service from the roofs, so that he decided to water-cool; the effect was so powerful that he could no longer melt steel satisfactorily. Again, we personally have so insulated a furnace that the life of the interior refractories has been considerably reduced. The reviewer watched with interest the development of the design of electrical-resistance furnaces to the point that complete freedom from any chimney effect was perfected. Then came the simple, yet extremely important, discovery that still hot air was a bad conductor of heat, and with it the design of forced-air circulation furnaces. Birmingham Electric Furnaces, Limited, Birlec Works, Tyburn Road, Erdington, Birmingham, have now produced a pamphlet specially devoted to this development. Of major importance is the use of this type of furnace for the quite low-temperature heat-treatment of aluminium piston pots. This air-circulation method is now accepted as standard for all heat-treatment jobs requiring precision, for all operations right up to the hardening of high-speed steel. All this is described and illustrated in this twelve-page booklet.

Pig-iron Sales to Italy

As a result of representations made to the Board of Trade Tees-side pig-iron exporters are hopeful of new arrangements being concluded with the Italian Government which will facilitate the transfer of currency from Rome. It is claimed that under the recent regulations, which expired on June 30, currency transfers had become virtually impossible and pig-iron shipments from the Tees to Italian ports have almost ceased. One leading exporter states that 2,000 to 3,000 tons of pig-iron could be shipped to Italy at short notice if speedier transfer of currency were possible, but his firm had so much money tied up in Italy that they could not afford to risk any more. Existing terms, however, are being revised, and there are hopes of an agreement which will permit of greater freedom of trade.

XUM

Sand Problems in a Brass Foundry*

By F. HOWITT

The past few years have witnessed an increasingly insistent demand for a higher level of quality in brass castings. With the rapid development of the hot-forging process and the consequent competition, new standards of comparison have been set up, and the resources of the foundry have been heavily taxed in the effort to realise them. This applies not only to the brasses, but to the gunmetals and bronzes also, for in many cases stamped brass has been substituted for these alloys, and is now used by engineers, and, more significant, appears in engineering specifications for purposes where gunmetal and bronze, formerly, were used exclusively.

The extended use of electro-plating, more particularly chromium plating, has also had a pronounced effect in creating a demand for castings of higher quality, for it is a fact that the high polish necessary for these processes renders very small surface defects easily visible. It is here that stamped articles score heavily, because the nature of the process ensures that the surface shall be free from such blemishes, whereas that of sand castings is never free from embedded particles of sand, or possibly minute cavities formed during solidification by the liberation of gas absorbed in melting.

It is probable that the efficiency and reliability of the casting process is, in general, much less than that of the other major fabricating processes. There are many reasons for this, but chief among them is the lack of fundamental knowledge. On this account the brass foundry is in a poor position to defend itself against the inroads made by the newer, more scientific processes, and the position is likely to become more acute in the future. There is, in brass foundries, a great wealth of empirical knowledge, much of it authentic, but a quantity of it is based on misunderstanding of the phenomena involved, most of it is confused and uncertain and little is co-ordinated or even recorded.

Fundamental Knowledge Lacking

The laws which govern the successful manufacture of castings are only superficially known or vaguely suspected. Compared with the other branches of metallurgy development in this field has taken place at a relatively slow rate. There is a definite reason for this, for where there are many contributory factors, as there are in the manufacture of castings, and each is apparently subject to spontaneous variation, the isolation of any one in order to determine its significance is extremely difficult. In these circumstances, one is compelled to regard the results of direct experiment with suspicion.

The degree of uncertainty and the seeming contradictions which attend the making of brass castings are a direct result of these variations, and the author desires, in this Paper, to give an account of some methods which may be adopted to reduce them to reasonable proportions.

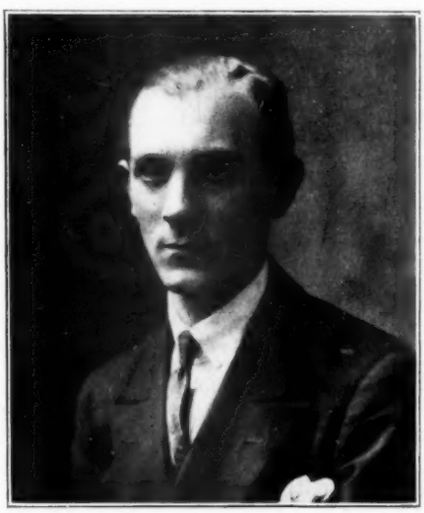
If castings be subjected to tests which determine their relative soundness, such as hydraulic pressure or polishing tests, it is found that some are good, some bad, and some are indifferent. Clearly, then, there are variations in the process which operate obscurely, and they occur not only between one batch and another, nor between one mould and another, but between individual castings in the same mould.

Sand—the Cardinal Consideration

Further, if the unsound castings be dissected, and the defects examined, provided that primary precautions have been taken in the melting and casting, it is found that easily the largest number of defects is caused, directly or indirectly, by sand. This is determined by the actual presence of sand in the defects, which is not revealed, in most cases, until it is examined under a moderate power microscope. This sand finds its way into the casting by various ways, and may come from either the core or the mould. Its presence in some cases and absence in others, and the many forms in which it is manifest, are a sure indication of the variable character of the medium and its manipulation.

Certainly the most inconsistent of all the materials met with which the foundry has to deal is moulding sand. It is of a complex nature, consisting essentially of sand grains proper, clay or other colloidal matter and moisture. All of these are liable to vary, and therefore to affect the properties of the sand.

Variations in moisture, for instance, produce variations in cohesion and plasticity, so that under a given load, which is the condition prevailing in machine moulding, the sand will ram more or less densely. This produces corresponding changes in the permeability and the strength.



MR. F. HOWITT.

Influence of Moisture Content on Bunter Sand

In a certain moulding sand, for example, drawn from the Red Bunter deposits, the writer observed that an increase from 5.5 to 6.0 per cent. in moisture produced an increase from 1.61 to 1.68 in density. At the same time the permeability fell from a value corresponding to 22.5 on the A.F.A. scale to 19.5, whilst the green strength increased from 375 grams per sq. cm. to 410 grams per sq. cm. In another sand treated in the same manner, the density rose from 1.57 to 1.66 and the accompanying changes in permeability and green strength were from 26 to 22.5 and 350 grams per sq. cm. to 386 grams per sq. cm. respectively. Both these sands had to be worked with the moisture content as near to 5.5 per cent. as possible. Below 5 per cent. the cohesion was insufficient to give a good "lift." Above 6 per cent. trouble was experienced from minute blows, which gave rise to subcutaneous defects, and these prevented a high finish being obtained. Behaviour of this kind is common to the Bunter sands, at least, and is quite liable to spoil castings, particularly when such castings are to be chromium plated.

It is, in general, necessary to control the moisture to within a minimum of at least 1 per cent. and this is not easily accomplished. The moisture in the new sand is rarely consistent; that in the spent sand is still less and the amount lost by evaporation in the milling process will vary enormously according to the conditions prevailing, such as atmospheric temperature and humidity, etc.

For instance, it was found that if a heap of sand was allowed to collect under the aerator, differences as much as 0.5 per cent. moisture could be obtained between the top and bottom of the heap. This was due to the difference in distance traversed; the further the sand was thrown the more moisture it lost.

Moisture Control

The control here took the form of an electrical moisture indicator arranged so that determinations could be made in a few seconds. Samples from the aerator are tested every few minutes and the water addition is adjusted accordingly. It is found that the moisture content can be controlled to within 0.5 per cent. The readings on the indicator are quite arbitrary, but with the same sand and water supply this is immaterial.

The clayey matter in a moulding sand can vary in both quality and quantity. The more finely divided or colloidal it is the greater will be its strength, and therefore the state of subdivision is of great importance. Unfortunately, the ferruginous bonds of the Bunter sands are not very highly colloidal and often contain a large amount of silt. The character of the bond, however, appears to be fairly constant in the same sand, but the quantity can, and does, vary.

This leads to variation in the strength of the sand and to the optimum moisture content which can be rectified by admixing more or less new sand. It is not, therefore, very serious where an adequate system of testing is maintained, but it also leads to minor complications in the mixing and milling process, where a larger quantity of new sand must be allowed a longer time to become thoroughly incorporated. This, necessarily, slows down the production of a batch system of sand preparation, but does not have that effect on a continuous system. In the latter case, arrangement is made for the sand to dwell longer under the rollers.

So far as the author has been able to determine by microscopic observation, there is little difference in grain shape in sand from a given source. There may, however, be considerable variation in grain size. Differences in grain size, of course, produce changes in permeability and strength. A smaller grain size will give lower permeability and, with the same milling and bond conditions, a finer sand will possess lower strength. Consequently variation in grain size may easily produce considerable variation in the properties of the sand.

Variation in Grain Size

From a series of physical analyses of sand from a certain source the author found that the grain size altered considerably, and did indeed result in fairly large differences in the properties of the sand. A number of the results of these analyses are reproduced in Fig. 1. This is part of a chart compiled from the analyses, but slightly modified to avoid complexity.* The one set of ordinates refers to percentage weight of the different constituents whilst the other set is quite arbitrary and refers to successive consignments of new sand.

It will be seen that the moisture varies from 8 to 16 per cent., whilst the quantity of bond varies from 10 to 15 per cent., facts which are very disconcerting even when adequate provision is made for tests on the sand in use. Such extreme variation in moisture may well have the effect of placing either the moisture or bond beyond control. It is, moreover, fairly typical of any open-worked fluvio-glacial sand and a large exposure of the workings to the weather will obviously produce great differences in the moisture.

The sand grains themselves have been classified under two heads, namely, those greater and

* A Paper read before the Annual Conference of the Institute of British Foundrymen held at Sheffield, July 2 to 5, 1935.

those less than 0.006 in. From the chart, they are seen to vary enormously and the reason for the inconsistencies before mentioned is apparent. The sands containing most of the coarse constituent are of higher permeability; those containing most of the finer constituent are of lower permeability. The alteration, calculated to agree with the A.F.A. scale was from 31 in the No. 5 sample to 20.5 in the No. 7 sample. The measurements were made on specimens arranged to contain 5 per cent. moisture and were rammed

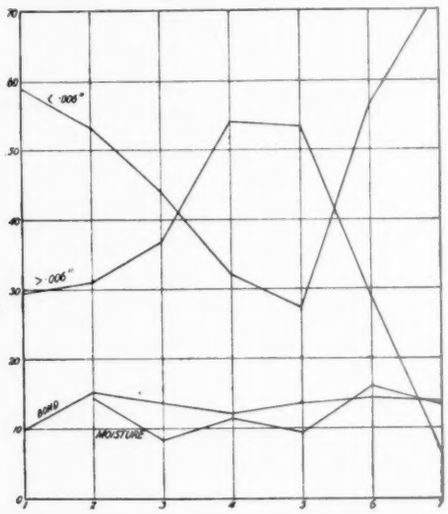


FIG. 1.—SHOWING VARIATION OF GRAIN SIZE IN SUCCESSIVE DELIVERIES OF NEW SAND.

under a load of 2.6 kg. per sq. cm., which is the pressure at which the moulding machines operate.

Recording Grain Size

In order to obtain a clear idea of the distribution of the different grain sizes, individual curves were plotted for all the sands under examination. A number of them are reproduced in Figs. 2 to 12. Since they differ from the ordinary cumulative curves it is necessary to explain their construction.

In the first place, ordinates are set out at distances from the zero to correspond with the apertures of the sieves used in grading the sample. These distances are arranged on a linear scale of thousandths of an inch instead of the rather meaningless denominational scale sometimes adopted. Those used here are 2.1, 3.0, 4.0, 5.1, 6.5 and 10.4 thousandths of an inch respectively. An ordinate is also drawn, tentatively at 0.001 in., to indicate the limit of the clay constituent. Its exact position is unimportant to the purpose of the diagram.

The weight of sand which remains between each pair of sieves is then divided by the difference between them. This gives the weight of sand per thousandth/inch for each pair and a horizontal line is drawn between the corresponding ordinates at a height proportional to this ratio. The area bounded by the horizontal line and the ordinate on either side is then proportional to the weight of sand remaining between the particular pair of sieves. In this way a connected series of lines is obtained throughout the range of the sand. These occur at greater or lesser heights which clearly show the occurrence of maximum and minimum points in the distribution of the grains. The regular curve is then drawn, which passes through these maxima and minima, in such a manner that the area contained between the curve and any pair of ordinates is the same as that between the ordinates and the horizontal line. Under this condition a strikingly accurate curve can be obtained. The whole area bounded by the curve is proportional to the total percentage of sand.

Interpretation of Curves

This curve has a definite mathematical significance. Its height at any point is the differential coefficient of weight of uniform grains per thousandth of an inch and it can be made to give the information associated with a differential curve. Its slope, for instance, indicates the rate of change from one grain size to another.

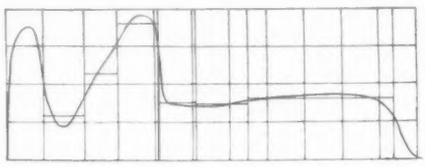


FIG. 3.—MEAN GRAIN SIZE 4.1.

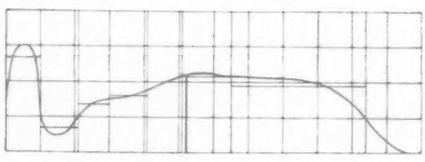


FIG. 4.—MEAN GRAIN SIZE 5.2.

Its value lies, chiefly, in the fact that it provides a true picture of the constitution of the sand. It shows the way in which the dominant grain sizes are disposed, how many dominant grain sizes there are and their relation to each other. It is, moreover, independent of the actual sizes of sieves used. No matter what series of ordinates is adopted, the same curve would be obtained provided that the same range were adequately covered. This makes the correlation of results an easy matter, for results from one source are strictly comparable with those from another, which is a highly desirable circumstance unattainable merely by comparison of results of analysis or cumulative curves.

A figure is given with the diagram for each sand for the mean grain size and its position relative to the curve is fixed by a thick vertical line. This was obtained by the method first published, the writer thinks, by Primrose and attributed to Scott. It was subsequently adopted by the A.F.A. It has here been modified from the irrational denominational scale to the linear scale and the figures are given in thousandths of an inch.

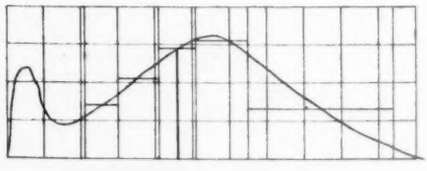


FIG. 2.—MEAN GRAIN SIZE 4.6.

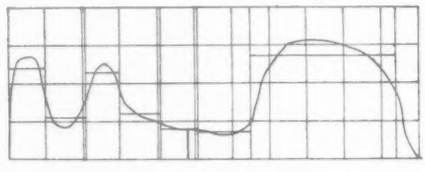


FIG. 5.—MEAN GRAIN SIZE 4.8.

Figs. 2 to 7 are the diagrams for the series of sands shown in Fig. 1. It will be observed that they are vastly different in character. The mean grain size fluctuates from 4.1 to 5.2 and occurs sometimes near a maximum point as in Fig. 2, but mostly near to the minimum. This means that the sands contain comparatively few grains of their mean grain size, a circumstance which is undesirable in a moulding sand. Incidentally, this can be quantitatively estimated from the diagram.

Further, with one, or possibly two, exceptions this series shows two maximum points, which clearly indicates that the samples are mixtures of two sands of markedly different grain size. These vary in quantity with respect to each other throughout the series, thereby producing the difference in properties before mentioned.

Examination at the Quarry

With a view to reducing or possibly eliminating this dual character of the sand, the bed from which it is derived was examined. It was seen to consist of several seams, apparently similar in character. Samples were taken from each of these seams separately, and each sample was duplicated some distance away from the original point. The object in doing this was not only to ascertain the precise differences between the seams, but also to form an idea of the possible variation within them. It is unnecessary to the purpose of this Paper to reproduce all the results of the examination of these samples. Three only are given, Figs. 13, 14 and 15. Fig. 13 is the diagram of the seam which was finally adopted. Figs. 14 and 15 are those of other seams from the same bed. Suffice it to say that the individual seams were very dissimilar in character and the diagrams 13, 14 and 15 are merely typical. Moreover, they appear to be fairly typical of the dissimilarity which may exist between juxtaposed seams anywhere in the Bunter system.

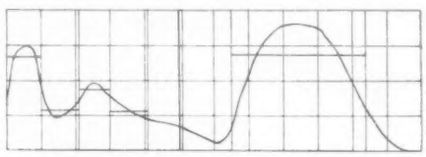


FIG. 6.—MEAN GRAIN SIZE 5.05.

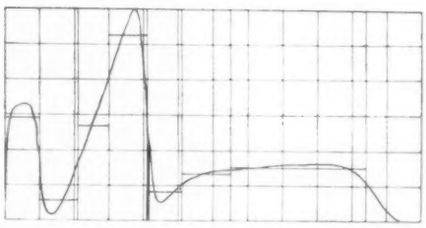


FIG. 7.—MEAN GRAIN SIZE 4.15. THE DIAGRAM FOR NO. 6 SAMPLE IN FIG. 1 IS SIMILAR TO THE ABOVE, AND IS THEREFORE NOT REPRODUCED.

The variation within the seams appeared to be comparatively small. Some seams were better than others in this respect, but the extreme difference found was probably no more than could be expected from a sand formed under fluvio-glacial conditions. This has been confirmed by comparison with sands drawn from other sources. It appears, moreover, to be of little importance from the practical standpoint.

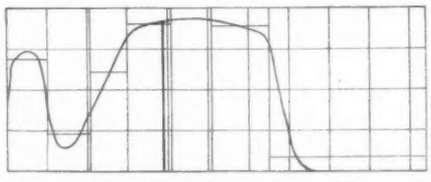


FIG. 8.—MEAN GRAIN SIZE 3.87.

Basic Dual Character

The most striking fact in connection with the examination is that the dual character of the sands is evident in each seam of sand. This means that it is not produced by adventitious mixing of dissimilar seams, though this may

serve to emphasise it, but it is an inherent characteristic.

That this is a fact has been verified by examination of sands from other sources. Samples have been obtained from widely different points in Nottinghamshire and Yorkshire and upon examination, have, with one exception, revealed the same characteristics, namely, that they are mixtures of two or more sands. Rarely are there more than two. The author has met with only one sand which shows three maxima and has never seen one with more. With regard to the exception mentioned above, this is definitely a single sand and approximates to the fine constituent of the dual sands. It was probably formed under abnormal conditions during the early part of the glacial period and there is, moreover, very little to be found.

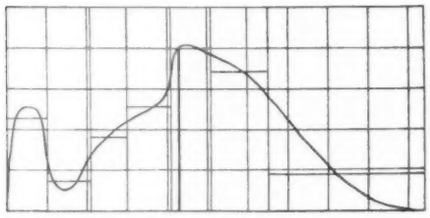


FIG. 9.—MEAN GRAIN SIZE 3.96.

Fig. 13 is the characteristic of the seam from which it was decided to draw supplies for use. The choice was made for definite reasons, quite apart from the fact that the bond was satisfactory and the grain size adequate. It will be seen from the curve that, in common with the other sands, this also consists of two maxima. But in this case they have moved closer together so that they merge into a single rather broad maximum. It is obvious that if, for any reason, the respective amounts of the two dominant grains were to vary, it would produce less difference in the mean grain size than would occur if the dominant grains were very dissimilar. That such fluctuations were probable is shown by the curves Figs. 2 to 7, where the main differences are the respective amounts of the two chief grain sizes. It was thought that in this way some measure of consistency could be obtained, since it was quite clear that the variation in grain size was responsible for the inconsistencies experienced in the strength and permeability of the sand in use. Moreover, in such a sand where the minimum point is suppressed, there would be the highest number of grains of mean grain size.

Behaviour of Controlled Sand Supply

This view was amply substantiated by subsequent experience. Figs. 8 to 12 are typical diagrams of the sand received after the examination of the bed. It will be seen that they are similar in form, but that the two maxima vary as expected. Despite this, the mean grain size varies only from 3.75 to 4.32 $\times 10^{-4}$ in., and that over a period of about five months the permeability became constant between 22 and 26 and the green strength varied only between 350 and 400 grms. per cm^2. Altogether, a fair degree of reliability was obtained and this was reflected in better achievement in the foundry.

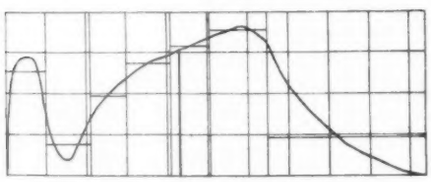


FIG. 10.—MEAN GRAIN SIZE 4.32.

Subsequently it was ascertained that the overlapping of the two maxima is a characteristic of the more famous moulding sands, although these are not necessarily suitable for every purpose.

Core Sands

The question of the suitability of a sand for a given purpose appears to be a very open one. The only determinate method seems to be the choice of a suitable grain size by experience or usage, and then to find the highest quality sand which approaches it. This problem applies, also, to sands for coremaking, and possibly to a larger degree, despite the fact that the extended use of bondless oil-sands has done much to eliminate the uncertainties attached to this operation. There are cases where it is impracticable to use bondless oil-sand for economic reasons, and in such cases it is still customary in brass-foundries to use spent moulding sand for cores.

This practice is unsatisfactory, since sands which are suitable for use under the low gas-pressure conditions which exist in the mould are unsuited to the high-pressure conditions which prevail in the core. Moulding sands for brass are necessarily of fine grain, and therefore of low basic permeability. High permeability is required in cores so that the gas formed during casting may be evacuated at a sufficiently low pressure. Further, the bond in the black sand consists of that proportion of clay and starch or other organic binder which remain from the previous casting operation, and is therefore small. It is not easy to supplement them. Additions of clay reduce the permeability still further and make the core difficult to remove from the casting, whilst additions of organic binder increase the gas evolved. Hence it is necessary to increase the permeability of the sand in some manner, and this is usually accomplished by light ramming.

These two conditions, low bond and light ramming, result in cores which are physically weak and variable in character. They need careful handling to avoid breakage and, on account of their low cohesive strength, almost invariably shed sand into the mould whilst being laid.

The author examined a large number of such cores with an instrument constructed to measure the permeability in the actual cores. This revealed differences in similar cores, which precluded the possibility of good castings being made with them all. Those of higher permeability than the average were physically weak and liable to erode or collapse under the impact of the metal stream. Those of lower permeability, whilst being stronger, showed a marked tendency to blow.

Overcoming Core Troubles

An attempt was made to increase the permeability by mixing coarser sand with the black sand, and making an addition of liquid binder. This proved only partially successful for several reasons, the chief one being the absorption of moisture by the baked cores on account of the type of binder employed.

The idea was then formed of a sand which could not be rammed too hard. When sand is rammed under a gradually increasing load there is a gradual decrease in permeability, and a gradual increase in both green and dry strengths. These changes are not proportional to the load applied, but increase rapidly at first, and then die away until finally a large increase in the applied force produces no change in the physical properties of the rammed sand. At this point the grains of sand are in close contact, and obviously until the pressure reaches that necessary to rupture the sand grains themselves no further change is possible. This latter force is many times greater than that required to produce complete compression, and it happens, therefore, that for all sands there is a range of pressure within which variation in the ramming load produces no change in permeability and strength.

The minimum of this range of pressure depends upon the type of sand employed, being less for coarse sands than for fine; less for rounded grains than for angular grains; and less for sands containing an oil binder than for those in which a clay binder is used. For instance, with dry sand containing no binder, no external pressure is required to bring the grains into close contact. With the bondless oil-sands very low pressure, about 1 lb. per sq. in., is sufficient, and with the plastic dextrin-oil sands pressures of about 5 to 15 lbs. per sq. in. are required, whilst with the fine, angular grain moulding sands containing large amounts of clay, pressures of 80 to 200 lbs. per sq. in., according to the plasticity of the sand, are usually adequate.

Fully Compressed Sands

In the fully-compressed state, a sand develops its minimum permeability, and it is necessary, therefore, to select a sand in which the grains are sufficiently large and regular in size. At the same time, it develops its maximum green and dry strengths, and is therefore more able to withstand the stresses to which it is subjected in use, such as the erosive effect of a stream of molten metal, which is a frequent cause of losses in a brass foundry. More important, however, a sand fully compressed is very consistent in behaviour, being of equal hardness throughout its mass. The desirability of this condition will be appreciated when it is remembered that few moulds rammed on even modern moulding machines are equally hard over the whole face or from face to back. They are usually harder towards the centre of the face and softer towards the edges, so that the middle of the mould will tend to blow whilst the edges may give way under the hydrostatic pressure of the metal and the mould "lift." There is a similar variation from the face to the back or *vice versa*, according to the direction of the ramming pressure.

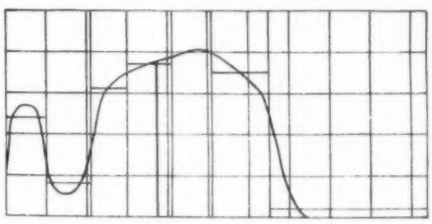


FIG. 11.—MEAN GRAIN SIZE 3.75.

It has not yet, however, been found possible to apply this principle to moulding, largely owing to lack of a suitable sand, but it proved very successful when applied to coremaking. A rounded-grain sea sand was first selected, having a mean grain size of about 0.009 in. and a base permeability of 107 according to the A.F.A. scale. Later, in certain cases, it was mixed with a sand having a mean grain size of 0.005 in. and a base permeability of 50 A.F.A. This was found necessary because some larger cores gave a rough surface to the interior of the casting, due to the fact that, with large ports, the gas pressure developed inside the core was insufficient to prevent the metal from entering the interstices between the sand grains. By using a mixture of the two sands, this could be avoided and the permeability adjusted to any desired value between the two extremes. Later still, it was found possible actually to calculate the permeability necessary to prevent a given core blowing on the one hand and leaving a rough surface on the other. The method is herewith.

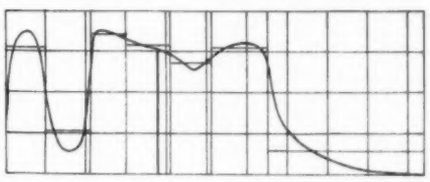


FIG. 12.—MEAN GRAIN SIZE 3.8.

XUM

Selection of a Binder

The selection of a binder proved to be difficult. Some dozens were tested before a satisfactory solution was found, and then only by compromise. The organic binders, without exception, gave too low a green bond. These cores, as in most brass foundries, are required to retain their shape with no more support than is afforded by a thin wire passed through their centre. Most of them are of intricate shape and overhang considerably in whatever position they are placed, so that high green strength and rigidity are required in order to avoid distortion. The one great virtue of black sand, which compensates to some extent for its deficiencies in other respects, is its enormous rigidity in the green state, and this is a property with which it is impossible to dispense in cores which cannot be supported at their extremities.

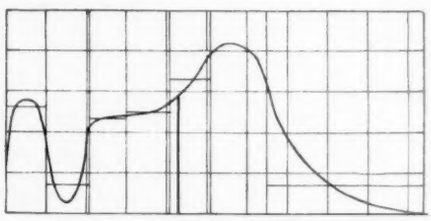


FIG. 13.—MEAN GRAIN SIZE 4.3.

It was eventually attained by using a mixture of bentonite and a dextrin-oil binder. With bentonite the green strength could be adjusted to whatever value was necessary, but used in excess it resulted in a serious decrease in the dry strength, due to absorption of the oil. A dextrin-oil binder was chosen because it contributes a certain amount of green strength, and therefore the amount of bentonite could be kept to the minimum. In this connection it is interesting to note that one serious disadvantage of the dextrin-oil binders disappears. As is well known, when using these binders alone, the moisture content of the sand must be kept very low, to less than 0.5 per cent. in fact, in order to develop green bond. This moisture evaporates quickly so that the working range is very short. But on the addition of about 1.5 per cent. bentonite, the moisture content can be raised to 3 or 4 per cent. and the sand remains workable at 1.5 per cent. Moreover, on account of the high absorptive property of bentonite, the moisture evaporates at a much slower rate and therefore the working range is lengthened very considerably.

Dextrin-Oil Binders

It was not found possible to use linseed oil with bentonite as is suggested owing to the fact that a large proportion of the oil is absorbed by the colloid. Consequently, the amount of oil required to produce a strong core is greatly in excess of that necessary without bentonite, and this leads to the production of large amounts of gas during casting. Moreover, the rate of penetration of oxygen into the bentonite-oil complex is much slower than into the oil alone, which circumstance unduly protracts the baking time.

These objections do not apply to the dextrin-oil binders to nearly the same extent. With these the amount of bentonite required is much smaller because of the green bond conferred by the dextrin and the presence of a fairly large volume of water renders the absorptive property of the bentonite of less consequence. In effect, linseed oil partially destroys the green strength of the bentonite, whilst the dextrin-oil intensifies it.

It was found that with 1 per cent. bentonite and 2 per cent. dextrin oil, the green and dry strengths of the sand were adequate for all ordinary purposes. The permeability could be brought to any desired value by adjusting the respective proportions of the two sands employed.

In use, the sand easily attains the condition of complete compression. Consequently it is impossible for the operator to decrease the permeability by ramming hard, for sand rammed in at one end of a corebox merely results in plastic flow and the emergence of sand elsewhere.

Core Surfaces

Reference has been made to a method whereby the most desirable permeability for a given core may be calculated. This is the permeability which will prevent the core blowing and, at the same time, will not permit the metal to enter the interstices between the grains of sand. The latter point, of course, can be accomplished by other means such as washing with graphite. In the case of large, heavy castings, cores protected in this manner are necessary for other reasons, but in the case of small cores, to which this method is intended particularly to apply, protection is uneconomic and difficult. Moreover, with large cores, and the necessarily large prints, little difficulty is, or should be, experienced from blowing. Consequently, fine-grain sand may be used and the surface tension of the metal will then be sufficient to prevent its penetrating the core.

When molten metal comes into contact with a core, gas is evolved as a result of the decomposition of the bond. This gas, together with the air already present, is expanded to two or three times its normal volume by the rise in temperature. There is therefore, a rapid increase in pressure inside the core. The height to which this pressure will rise depends on the rate at which the gas is liberated and the rate at which it can be evacuated. The former is governed by several factors which cannot be calculated, but it can be found experimentally as is shown later. The latter depends solely on the permeability and the pressure of the gas, but if this pressure becomes equal to or greater than the pressure of the metal around the core, then metal will be displaced by gas and a "blow" will appear.

Determination of Metal Pressure

The determining factor then is the pressure of the metal and this may be taken as the product of the height of metal in the runner and the density. The critical period occurs from the point at which the core is submerged to that at which the first skin of solid metal forms around it. Previous to this, exhaustion of the gas can

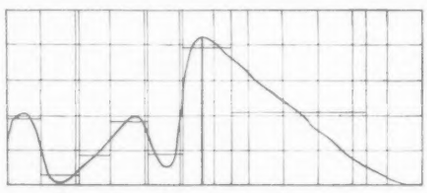


FIG. 15.—MEAN GRAIN SIZE 5.66.

take place, not only through the ports, but also through the face of the mould. For this reason it is found that blowing usually takes place during the period mentioned. Throughout it the pressure is static.

The formula for permeability states that—

$$\text{Permeability} = \frac{\text{Volume of gas} \times \text{length of core}}{\text{Pressure} \times \text{Area of core} \times \text{Time}}$$

or

$$Pe = \frac{VL}{PAT}.$$

Modifying this slightly:—

$$P = \frac{L}{PeA}\,\frac{V}{T}.$$

If, then, the ratio $\frac{V}{T}$ could be found, it would be possible to ascertain the value of the pressure in the core by measuring its length, area and permeability. This holds good only for the simple regular form embodied in the formula. Few cores, however, are simple and regular, and it is necessary, therefore, to modify the formula for variations from the simple form.

Assuming that the volume of gas evolved is proportionate to the volume of the core itself, it is necessary to divide the volume of the core by the volume of the simple form. The formula is then multiplied by this ratio. It should be noted that the volume of the simple form is the product of its area and length. The formula then becomes:—

$$P = \frac{V}{T}\,\frac{L}{PeA}\,\frac{\text{Vol. of core V(c)}}{AL}$$

or

$$P = \frac{V}{T}\,\frac{V(c)}{PeA^2}.$$

It will be observed that the value L is thus eliminated.

The volume of the core can be found in several ways; for instance, by weighing it and

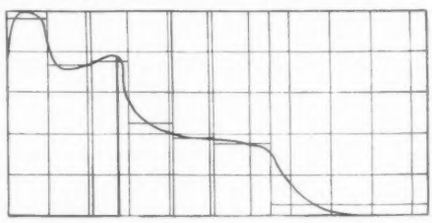


FIG. 14.—MEAN GRAIN SIZE 2.73.

dividing by the density; or it may be calculated from drawings of projected castings.

The ratio $\frac{V}{T}$ is the rate at which gas is evolved during the critical period. It is found by experiment, or possibly by experience. It is not possible to calculate it or to estimate it analytically, because it depends to a large extent on unknown quantities, such as the rate at which heat penetrates the core, the exact composition and temperature of the gas, etc. It bears only a general relationship to the total volume of gas present.

Blowing Control

If, however, a certain core is known to blow, or to give a large proportion of blown castings, it is clear that the pressure in such a core must rise to approximately that of the head of metal. Using this as the value of P in the formula, and taking the dimensions of the core for the other quantities, it is possible to calculate $\frac{V}{T}$ for this particular case.

Alternatively, cores may be made which are intended to blow. For instance, a series of cores of different lengths, but having the same cross-section and permeability, may be cast in a mould adapted to take them. It should be arranged that the cores are cast simultaneously, and the mould should conform to the standard practice. Then, provided that the specimens were made long enough, the longer ones will be found to blow and the ratio $\frac{V}{T}$ calculated for the shortest of these. It is necessary to emphasise that such specimens should be of precisely similar character one to another and to the cores which they are intended to represent. Differences in permeability, quantity of binder, baking time or temperature will give inconsistent results and, incidentally, such inconsistencies are an indication of variable practice.

The value of the ratio $\frac{V}{T}$, so obtained, is used to calculate the pressure P developed by any other core made from the same materials and used under the same conditions. If it is found that this approaches the pressure of the head of metal, then it is probable that blowing will occur, and the core should be modified accordingly. Similarly, if it is found that the gas pressure is low, compared with head of metal, then penetration is likely, and roughness will result.

There are several ways in which suitable modifications may be effected. The best is to adjust the permeability by admixing more or less fine or coarse sand accordingly as it is required to raise or lower the permeability. Alternatively and where possible the length or cross-sectional area of the core may be altered. For instance, the pressure developed is proportional to the cross-sectional area; that is to the diameter^2 and consequently a small increase in diameter may result in a considerable decrease in the pressure. Patternmakers are usually generous in machining allowances at points where cores issue from castings and it is often possible to reduce this, thereby increasing the diameter of the core.

Alternative Methods

Another way is to raise or lower the gasifiable matter in the core by adjusting the quantity of binder used or altering the baking time or temperature. This is not advisable because it implies departure from a presumably satisfactory standard process and the cores will be deficient in some respect. It is, however, useful as a last resort, for example, in the case where the limit of permeability has been reached with the sands usually employed. In one such case it was found beneficial to bake the cores for a longer time and at a higher temperature than usual, thereby eliminating a persistent case of blowing.

It should be pointed out that to increase the head of metal only is not a remedial measure. This has the effect of admitting metal to the mould at a faster rate and consequently the rate at which the gas is evolved increases. In effect, the ratio $\frac{V}{T}$ is increased roughly in proportion to the increased head. To maintain the same rate of flow into the mould with increased casting pressure, the size of gates and runners must be reduced, and this entails other difficulties which it were better not to encounter. The modification required should take the form of alteration to the core itself along the lines suggested and not to extraneous conditions. By so doing the stability of other factors is not affected.

The permeability required for the calculation is that of the core itself and not that of an arbitrary standard. This, however, should offer little difficulty, since it is only necessary to measure the permeability of specimens made according to the adopted practice.

The area is taken as being that of the outlet or port. This is not strictly correct, but the inaccuracy is comparatively small. Where there are more than one outlet for the gases, the term A^2 becomes $A_1^2 + A_2^2 +$ etc., where A_1 relates to the size of one outlet, A_2 to that of another, etc.

For ordinary bondless oil-sands containing 2 per cent. linseed oil and baked for 1 hr. at 380 deg. Fah. (193 deg. C.), the ratio $\frac{V}{T}$ appears to be about 700 c.c. per min. For the green-bond sand previously described baked for the same time and at the same temperature it is about 750 c.c. per min. No definite figure can be given for black sand, but it appears to be considerably lower. These figures, however, are intended only as a rough guide since the ratio must vary according to individual practice. Conditions should be arranged so that the pressure developed is about half to three-quarters of the casting pressure and, if this be done, the method is eminently suitable for use under practical conditions.

In conclusion, the writer desires to express his regret that it has not been possible to adduce proof of all the statements made. To do so would unduly prolong the Paper and serve little useful purpose, since he believes that such statements will be generally acceptable and are, in fact, self-evident.

He also wishes to express his appreciation to Messrs. Peglers, Limited, of Doncaster, for their kind permission to publish data collected in their foundry and his sincere thanks to Mr. Austin Crowther for his helpful criticisms.

A New Type of Crucible Furnace

During a visit to the works of Messrs. R. Hoe & Company, of the Borough, London, S.E., we were impressed with a new installation which had been made of quite a small crucible plant which, nevertheless, has been the means of replacing three ordinary pit-fired furnaces. This new installation, which is illustrated in Fig. 1, retains

FIG. 1.—A NEW TYPE OF CRUCIBLE MELTING FURNACE INSTALLED AT THE WORKS OF MESSRS. R. HOE & COMPANY.

all the well-known and much-appreciated advantages of the old-fashioned crucible furnace but, at the same time, it effects some rather notable economies. Under the conditions which obtained at this foundry, it was customary to use, for the melting of 150-lb. charge of gun-metal, 120 lbs. of special coke, whereas, with this new furnace, the consumption has been reduced to 30 lbs. of a well-known brand of Newcastle coke. The main feature, however, is the extraordinary reduction of time. Still referring to 150-lb. charge of gun-metal, the pit fires required 2½ hrs. for melting the charge, whereas now it is merely a matter of 45 to 50 min., so that as many as seven or eight heats can be obtained per diem.

Whilst this question of fuel and time reduction is of paramount importance, the major effect is perhaps reflected in the overhead charges, as the pit-type furnaces require men to arrive early in the morning and also there is the question of week-end repairs. With such a short melting cycle as 50 min., the general speed-up of the shop is a natural result, as the floor space can be more economically utilised.

The furnace is quite simple in construction and consists of a casing lined with refractory material, which is sunk for about half its height below the ground. It differs, fundamentally, from the pit-fired furnace in that the grate bar is replaced by an easily-removable grill. This grill is a plate-like casting, with peripheral and centrally-disposed circular apertures. It is dropped by the removal of two supporting round bars. The front of the ash pit is sealed by a well-fitting shutter and beneath the grill is introduced, by means of a flexible pipe, a blast of air from a fan which is driven by a ½-h.p. motor. In front of the ash pit, and attached to the casing of the furnace, is a box-like construction having a curved bottom plate and a covering plate. The removal of the covering plate and the lifting of the shutter in front of the firebox allows the grill to be dropped and removed, and it is a very easy matter to shovel out the ashes. Towards the top of the furnace proper there is provided a flue leading to the main chimney.

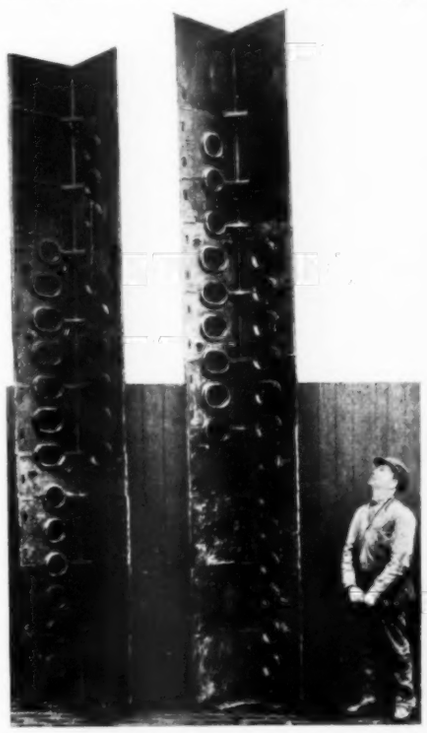
It is clear from the conditions which obtain in the foundry of Messrs. Hoe, that the output from the floor space could be easily doubled by the use of two such furnaces as have been described. Because of the shorter duration of the charges, an increased crucible life is being obtained and, in the particular case under review, the normal life of from 50 to 60 has been increased to 150 at a minimum. The temperature attained is such that the furnace is suitable for melting even steel, though, obviously, the times and other conditions which we have outlined would be of a somewhat different order.

We wish to acknowledge our indebtedness to Mr. Whitworth, of Messrs. Hoe & Company, for supplying the working figures which have been set out above, and which indicate that very material savings can be effected.

The furnace is being marketed in Great Britain and the Empire by Mr. E. Cecil Kny, of 19-21, Palace Street, London, S.W.1.

Heat-Resisting Nickel-Chromium Steel Castings

Destined to remain at a temperature of between 700 and 800 deg. C. for six and seven years at a time, the special castings illustrated below are of exceptional interest. They were made by Head, Wrightson & Company, Limited, Thornaby-on-Tees, who have specialised for a number of years in the manufacture of high-grade heat-resisting steels. These particular castings are of their special "Abednego" heat-resisting steel which contains a substantial per-



centage of nickel. The company's metallurgists found the nickel addition necessary to enable this steel to maintain its strength and resistance to creep after very long periods at high temperatures.

TATA, LIMITED, have removed from Capel House, New Broad Street, E.C.2, to Thames House, Millbank, London, S.W.1.

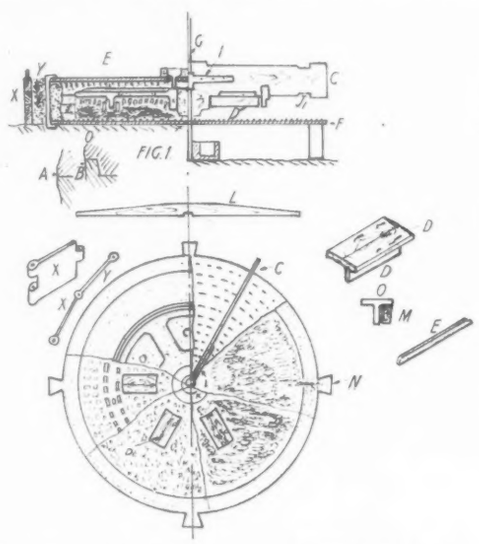
XUM

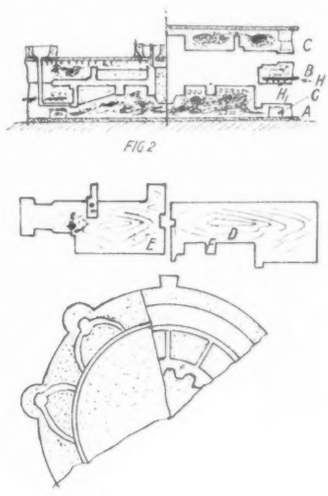
Pages from a Foundryman's Notebook

2.—MAKING DRUMSIDES IN LOAM

By "RECORDER"

Of recent years the art of loam moulding has not been practised as extensively as a couple or three decades ago. Amongst the reasons for this may be cited the passing of certain types of steam engines and also the fact that for a number of castings dry-sand moulding from a pattern offers many advantages as regards speed of production and cost. While this is so, loam moulding is still used for certain jobs, yet a large majority of first-class craftsmen never have the opportunity of becoming acquainted with this branch of their craft. For the benefit of such and also for apprentices, the following example of making loam moulds for the sides of a drum of a hoisting engine is taken as illustrating many of the principles of loam moulding. It may be well before describing the illustrations, to say that, unlike green- and dry-sand moulds which are formed by consolidating sand around a pattern, loam moulds are made by striking shapes up in loam—which is a mixture of old sand, new sand, chopped straw, sawdust, etc., to make it permeable, and a large percentage of water—by strickle boards. Also, that instead of being made in boxes, loam moulds are built of brick on strong iron plates and cramped together for casting and surrounded by a ring which is packed tight with sand to avoid a run-out. As no box parts are used and therefore no pins for ensuring correct location of mould and cope, other means have to be adopted. The method used is to sweep a definite size on each half of the mould and assemble by this and a centre line drawn over the face of the mould and carried over the side. This type guide is spoken of as a "feeler" guide and is shown at A, and is considered better than B which is known as a fitting guide. The objection to B is that on assembly a "crush" may take place. Fig. 1 shows a half section through the assembled mould of the plain drumside with the sweeping board clamped to the bar in the other half view. The plan view is composed of a number of sections of the mould at different stages of building. Fig. 2 illustrates a section through the assembled mould of the brake race portion of the drumside. Referring to Fig. 1, the sweeping board is shown at C, the pattern work required for this example being sweep C, made of good quality, well-seasoned yellow pine, to counteract the dampness of the mould. If inferior timber were used trouble would be experienced through distortion. The six brackets as D are not varnished; it is better to use the natural wood surface rather than a varnished one which would tend to stick to the wet loam and not strip cleanly. There are six ribs for the cope as E. Each of the arms and ribs should have a centre line distinctly marked on to facilitate setting in the mould. In addition, the arms should have a mark at a definite distance from the centre on the centre line, this to be used for correct spacing. The pattern work being completed, the moulder can commence operations. Before any building is done a large plate of loam should be dried in the stove to be used later for reinforcing the mould. The various plates required should be taken from stock, or, if necessary, made in an open sand mould. Spindle G, consisting of a straight bar 2 in. dia., is set upright in the footstep H, and plate F is set on trestles or small moulding boxes on end, care being taken that it is level. Board C is now clamped to the bar by arm I. A layer of dry sand is placed over the plate which has a number of teeth cast on to hold the loam, and a ring J is built of fine bricks, jointed with wet loam, up to within ½ in. of the face of sweep J. The boss K is shaped up and arms O set in position. Two are first set by a straight-edge L, which has a portion cut out of the centre of the bar; this enables lines to be drawn directly through the centre. The arms are held in position by cakes of dried loam which have been coated with a layer of wet loam on the two faces coming in contact with them as M. The remaining four arms are now set in a similar way, the correct position being determined by testing with trammels the distance between each from the mark on the centre line D_1. The bottom is now covered with ashes for venting, and they are connected to the atmosphere at four places over the snugs as N. A ring of dried loam is now built inside and outside as O. All the interior being filled with ashes and packed tight to avoid the metal bursting in, these are then covered with a layer of loam reinforced by pieces of dried loam and swept up practically to size. This is then left to stiffen, while the cope is being prepared. For the cope a plate somewhat similar to the one for the bottom is required with teeth cast on





following the contour of the arms and with holes for runner and riser. This being set up similarly to the bottom plate, sweep C is taken off and reversed on the other spindle. Straw is now laid on, the purpose of which is for venting and to avoid "scaling down." Loam 2 in. thick is now swept on, and arms bedded in, the whole is reinforced by bits of dry loam and allowed to stiffen, while the bottom is finished off. This consists in again replacing sweep C and sweeping a thin mixture of loam all over the mould. The sweep is taken off, arms withdrawn, all necessary chamfers cut, and also radius on the pods cut to a template. A hole is made in each pod down to the ashes to assist in the drying. The cope also being finished off, they are both stoved, being dried by a slow fire to avoid cracking the face of the mould. When dried they are blackened and a centre line marked over each through an arm. The centre core being placed in position, they are then assembled by these marks and the "feeler" guide and cramped together. A ring of plates X is placed around the mould and the space Y is packed tight with sand and the runner made. This casting is run on the boss with a riser opposite and is entirely satisfactory. Having completed the plain portion, the side carrying the brake race can now be commenced. The left-hand side of Fig. 2 shows the mould assembled and the right-hand side that of the three portions before assembly, viz., A the bottom, B the ring and C the cope. It will be noticed that the guide is swept on B and C for assembling by, but none on A. One is not necessary here as ring B can be centred on the bottom quite easily, everything being in view. The sweeping boards are shown at D and E, D being the bottom while E carries both the ring and cope. F is the clutch ring and an aluminium pattern is placed in the space swept out by F on the board and teeth made up. This is better when a number are required over a period of years than using a wood segment with only two or three teeth. The bottom is commenced as for Fig. 1. G being a ring one brick deep and ashes and vents as before, this will be quite clear if the previous example is understood. Having built the bottom, it is left to stiffen before building in clutch ring F; in the meanwhile ring B is built on a previously prepared cast-iron ring H. The method is to use the bottom plate of the plain side and sweep a level surface, allow to stiffen and dust with parting sand. A thin layer of loam is now laid on this and plate H, which has previously been clay-washed, is bedded in, the teeth H_1 hold the thin layer of loam. This is then built and swept to shape. The cope is then prepared on a plate especially made with deep teeth between the arms to hold the pods. Plates are all made with an enlarged portion to take the runner as plan view. This example is run in the bottom; if run as previous example the continual flow of metal over the clutch ring would probably tend to scab the teeth. On drying this is assembled as plain portion and built around in a similar manner.

"Stahleisen" Publication List

Verlag Stahleisen m.b.H., Breite Strasse 27, Düsseldorf, the publishers of "Stahl und Eisen" and other leading metallurgical periodicals, has issued an interesting list of their publications, covering 56 pp. It gives full particulars of the scope, publication data, and subscription rates of the periodicals published by "Stahleisen," and a list of metallurgical books, many of them classics of German metallurgical literature. The bulk of the booklet gives detailed and complete lists of the reports issued by the 12 technical sub-committees and the Heat Economy Bureau of the Verein deutscher Eisenhüttenleute, which are valuable for reference purposes, especially as a concise index is appended to each list of reports. The reports of the Kaiser-Wilhelm-Institut für Eisenforschung, which now cover 270 pieces and 16 volumes, are listed in the same systematic way. Readers of German metallurgical literature will find this list a useful bibliographical reference work.

Sheffield Conference Visits

Worksop Works of General Refractories, Ltd.

One of the largest brick-producing works of General Refractories, Limited, is at Worksop. It is devoted mainly to the production of basic refractories, for use in open-hearth steel furnaces, billet-soaking pits, reheating furnaces, etc. Here may be seen the very latest equipment for the manufacture of refractory bricks and shapes. The chief raw materials used are magnesite and chrome ore, many thousands of tons of which are kept in stock.

A new brickmaking plant has recently been installed, and it is designed for continuous flow from crushing of the raw material to the final burning in the kiln. The raw lumps are first broken through a jaw crusher, then further reduced by means of a rotary-hammer crusher. The aggregate is next elevated to a nest of screens, where it is separated into four sizes, the largest of these being transferred automatically

PRESSING BASIC REFRACTORY BRICKS UNDER A LOAD OF 10,000 LBS. PER SQ. IN. AT THE WORKSOP WORKS OF GENERAL REFRACTORIES, LIMITED.

to a ball mill for further reduction. Based upon recent research, the separately-graded materials are then intensively mixed in definite proportions, designed to produce a brick of minimum porosity. The bricks are then dry-pressed under a load of 10,000 lbs. per sq. in.

Drying is carried out through tunnel dryers, the temperature of which is under careful pyrometric control. High-temperature kilns subject the products to temperatures up to 1,500 deg. C. The resulting bricks are hard, dense, perfect in shape, and results of service tests fully justify the extreme care taken in their manufacture.

At Worksop, too, a well-equipped laboratory enables the company's products to be tested regularly to ensure absolute standardisation. Physical tests of foundry sands are also carried out here. General Refractories, Limited, take considerable care in the recommendation of their moulding sands, and they treat the sand question of every foundry as an individual problem which they have every facility for solving.

The firm is now producing at Worksop the new Chamotte moulding compositions. These are graded compositions made from a vitrified aluminous material of very high refractoriness. Used in a somewhat different manner to ordinary steelmoulders' composition, Chamotte moulding gives extraordinarily clean finish to heavy steel castings.

The head office and sales centre of General Refractories are in Sheffield, the city of its origin, although the development of this company has now become world-wide. Its productions include refractory materials of every type, including magnesite, diazite, silica, chrome, sillimanite, mullite and fireclay bricks, moulding sands, ganisters and plastic refractories.

In the production of moulding and core sands this firm has exploited fully the unrivalled resources of this country, and for iron and brass work alone have over fifty different kinds of sands available. The quarries are situated in various parts of England and Scotland, and as much as 200,000 tons are handled annually. A particular speciality is Yorkshire sand for steel moulding. This sand has continued rapidly to gain favour and has eliminated the necessity of importing foreign sands for this purpose.

Anglo-Italian Trade

The Board of Trade desire to draw attention again to the provisions of the arrangements agreed between the British and Italian Governments on April 27, whereby debts due from persons in the United Kingdom for Italian goods imported into the United Kingdom and for freights for the carriage of goods in Italian ships between the two countries are payable into a special sterling account at the Bank of England. An appreciable volume of such debts continues to be paid direct to the Italian creditors concerned, and the sterling available to meet debts due from Italy for United Kingdom exports and for freights earned by British ships is to that extent reduced. The United Kingdom debtors concerned are earnestly requested to follow the agreed procedure and thereby to assist the prompt payment of debts due to this country from Italy.

A Hardness Conversion Chart

A hardness conversion chart which may prove useful is herewith reproduced. It has been compiled by T. N. Holden, 1219, Glenwood Road, Brooklyn, N.Y., secretary-treasurer of the New York Chapter of the American Society for Metals, and reproduced in "Metals and Alloys." It is similar to a table published by Mr. Holden a few years ago except that the Monotron Scale has been added.

	Rockwell diamond "C" scale			Brinell 10-mm. ball 3,000 kgm. load.		Tensile strength, equiv. 1,000 lbs. sq. in.	Scleroscope Uni. Ham.	Diamond ball brinell	Monotron ⅛-mm. ball depth 9/5,000 in.
	150 kgm.	100 kgm.	60 kgm.	Dia. of ball in mm.	Hardness no.				
	72	82	89	2.20	782	383	107	1,220	130
	69	80	87	2.25	744	365	100	1,114	120
	67	78	85	2.30	713	350	96	1,021	110
	65	76	84	2.35	683	334	92	940	101
	63	74	83	2.40	652	318	88	867	93
	61	72	82	2.45	627	307	85	803	86
	59	71	81	2.50	600	294	81	746	80
	58	69	80	2.55	578	282	76	694	74
	56	68	79	2.60	555	271	75	649	70
	54	67	78	2.65	532	260	72	606	66
	52	65	77	2.70	512	251	70	587	63
	51	64	76	2.75	495	242	68	551	60
	49	63	76	2.80	477	233	66	534	57
	48	62	75	2.85	460	226	64	502	54
	47	61	74	2.90	444	217	61	474	51
	45	60	73	2.95	430	210	59	460	49
	44	59	73	3.00	418	205	57	435	47
	43	58	72	3.05	402	197	55	423	46
	41	57	71	3.10	387	189	53	401	44
	40	56	71	3.15	375	183	52	390	42
	39	55	70	3.20	364	178	50	380	41
	38	54	69	3.25	351	172	49	361	39
	37	53	69	3.30	340	167	47	344	37
	36	52	68	3.35	332	162	46	335	36
	35	52	68	3.40	321	157	45	320	35
	34	51	67	3.45	311	152	44	312	34
	33	50	67	3.50	302	148	42	305	33
	31	49	66	3.55	293	144	41	291	32
	30	49	66	3.60	286	140	40	285	31
	29	48	65	3.65	277	136	39	278	30
	28	47	65	3.70	269	132	38	272	29
	27	46	64	3.75	262	128	37	261	28
	26	45	64	3.80	255	125	36	255	27
	25	45	63	3.85	248	121	36	250	27
100	24	44	63	3.90	241	118	35	240	26
99	23	43	62	3.95	235	115	34	235	25
98	22	42	62	4.00	228	113	33	226	24
97	21	41	61	4.05	223	109	33	221	23
97	20	41	61	4.10	217	106	32	217	22
96	19	40	60	4.15	212	104	31	213	22
95	18	39	60	4.20	207	101	30	209	22
94		38	59	4.25	202	99	30	201	21
93		37	58	4.30	196	96	29	197	21
92		36	58	4.35	192	94	29	190	20
91		35	57	4.40	187	91	28	186	20
89		34	56	4.45	183	90	28	183	19

"B" SCALE $\frac{1}{16}$-in. Ball. 100 KGM.

British Foundry School

Introduction

The British Foundry School has been established for the purpose of the further training of men who wish to qualify for positions of the highest responsibility in the foundry industry, or who have already achieved such positions and who wish to extend their metallurgical and technical knowledge to meet the very considerable advances that have been made during the past few years. It is primarily intended for chemists, engineers and metallurgists, and even managers, of establishments concerned with the founding of grey iron, white and chilled iron, malleable cast iron, steel and the non-ferrous metals, including alloys of copper, tin, zinc, nickel, aluminium and magnesium. Remarkable advances have taken place in this industry and particularly in those countries where facilities for the higher training of foundrymen are available.

The school forms part of the national scheme of foundry education established largely on the initiative of the Institute of British Foundrymen and the British Cast Iron Research Association. For the operatives in the industry, the moulder, coremaker, patternmaker, etc., courses are held in many technical colleges, and examinations are held annually by the City and Guilds of London Institute in patternmaking and in foundry science and practice. For the intermediate grades, foremen, chargehands, inspectors, testers, chemists, metallurgists, the Higher National Certificate of the Institution of Mechanical Engineers may be endorsed in founding. The British Foundry School completes this scheme by furnishing the necessary technical and metallurgical knowledge to those men who already had practical experience in the industry and who have demonstrated their capacity to take up higher responsibilities, or who have already done so.

The school, which is the only one of its kind, has national status. It is supported by the Board of Education. Through the public-spirited action of the Birmingham Education Committee it has been possible to house the school in the well-equipped Metallurgical Department of the Birmingham Central Technical College. The school is also officially supported by the following national bodies:—British Cast Iron Research Association; British Iron and Steel Federation (Iron and Steel Industrial Research Council); British Non-Ferrous Metals Research Association; City and Guilds of London Institute; Institute of British Foundrymen; Institute of Metals; Institution of Automobile Engineers; Institution of Mechanical Engineers; Iron and Steel Institute; National Light Castings Ironfounders' Federation, and Welsh Engineers' and Founders' Association.

These bodies, together with representatives of the Board of Education and the Birmingham Education Committee, form the Governing Body of the School. The school is also supported financially by a number of firms in the industry, and provision is made in the constitution for the representation of such subscribers on the Governing Body.

Conditions of Admission

There is no age limit for admission. Candidates for admission will normally have had practical experience in at least one branch of the industry, and great value is attached to this as the school will make no attempt to teach the practice of patternmaking or founding, which can only be acquired in works. With regard to technical qualifications, the Governing Body takes a broad view and will consider applications individually. The Governing Body will require to be satisfied that prospective students are in a position to profit by the instruction. In general, candidates must have reached a minimum standard of practical training equivalent to that suited to the examinations, either in patternmaking or in foundry practice and science, of the City and Guilds of London Institute. In technical studies the standard aimed at is equivalent to that required for a National Certificate. A university degree, or associate membership or associateship of one of the leading institutions in engineering or chemistry will be accepted as evidence of adequate preliminary knowledge. Students may be required to undertake a limited amount of evening study, but are recommended not to attend other classes or involve themselves in commitments which would prevent full attention being given to the work of the school, which will occupy the student's whole time.

Fees.—The course lasts one academic year, and the fee to students studying for the diploma is £30, payable in advance. At the discretion of the Governing Body students may be admitted who do not propose to take the diploma, the fee in respect of whom will be £100, payable in advance. Fees are not returnable.

Length of Course.—The course occupies one academic year of approximately forty weeks in length. The opening date and lengths of the three terms correspond approximately to those of the Birmingham Central Technical College, and it is intended that the school shall open on September 24, 1935, the first session ending early in July, 1936.

Diploma.—The school awards a Diploma to students who successfully complete the course, an it is expected that the Diploma will receive endorsement by the Board of Education.

Curriculum

The curriculum is based on a year's work of approximately forty weeks, lectures and laboratories each occupying approximately one-half the time. Part of the time will be occupied in weekly visits to foundries and blast-furnace plants for a detailed examination of their practice. Each student will be required to write a report in his own time on each visit. Once each session a visit will be paid to another foundry centre, during which a working week will be occupied with visits to foundries and blast-furnace plants. The final examination will consist in the working out by the student of a foundry project in complete detail, over a period of a working week, showing the student's grasp of the principles of both art and science.

While practical instruction in founding or patternmaking will not be attempted, the principles dealt with during the course will be practically illustrated as far as possible. The curriculum covers the founding of grey cast iron, white iron, malleable cast iron, steel and non-ferrous metals, and no part of the course may be omitted. The course aims at enabling the student to undertake: (1) to plan or adapt a foundry for any output or purpose required; (2) to take a sketch or a designer's conception of a casting in any material, to formulate the method of preparing the pattern, of planning the mode of production, of making the mould, of preparing the mixture and producing sound castings to any required specification by any method of melting. This will apply to any required quantity, small or large, of the product; (3) to formulate accurate estimates of cost of production and delivery time, with due regard to the quantity required and the equipment available; (4) to assess the respective merits of different types of material for castings and of cast and wrought materials for given applications.

The sections of the curriculum are briefly indicated as follow, although the right to modify details is reserved.

Lectures

The Founding Industry.—The founding of steel, cast iron, malleable cast iron and non-ferrous metals in Great Britain and abroad. The sections of the industry. Their relations to other branches of the engineering and of the iron and steel industries. Types of foundries. Detached and dependent foundries. Specialised and jobbing foundries. The internal structure of the industry. Technical and scientific institutions, research associations, trade associations. Grades of people employed in the industry and their functions. Methods of training and courses of instruction for apprentices, operatives, technical workers.

Foundry Organisation and Planning.—The location and planning of foundries. Foundries in relation to raw-material supplies, markets, labour and transport. Modern tendencies in continuous and mass production. Purchase of raw materials. The use of specifications in buying and selling. Selling problems and markets. Internal organisation and planning. Equipment and supplies. Costing.

Raw Materials.—Pig-irons. Charcoal irons. Hot- and cold-blast pig-irons. Refined irons. Fracture and analysis. Ferro alloys. Steel scrap. Cast-iron scrap. Non-ferrous metals and alloys. Fluxes. Moulding and core sands. Natural sands. Synthetic sands. Mixtures for light and heavy work. Repetition and jobbing work. Sand treatment in a mechanised plant. The effect of moisture, milling and ramming on sands. Properties affecting their use in the foundry. Grain size, refractoriness, strength, permeability. Use of coal dust and facings. Control of sands. Sand testing. Sand problems in relation to continuous production. Green-sand, dry-sand and loam working. The chemistry of oil-sand cores and core binders. Refractory materials for the foundry. Metallurgical coke. Coal, oil, pulverised fuel, gas and electricity as fuels for melting, annealing and other furnaces.

Processes and Equipment.—The foundry cupola. History and development. Melting losses. Oxidation losses. Carbon pick-up. Sulphur pick-up. Fluxes. Slags. Desulphurisation. Deoxidation. Receiver and non-receiver cupolas. Blowers and fans. Measurement of molten-metal temperatures. Ferro-alloy additions. Mechanical charging. The crucible furnace for ferrous and non-ferrous melting. The air furnace. The rotary pulverised-fuel and oil-fired furnaces. The electric induction furnace. Arc furnaces. The converter. The open-hearth furnace. Foundry pyrometry. The tools of the moulder, coremaker and patternmaker. Moulding and coremaking practice. Patternmaking. Moulding machines. The after-treatment of cast iron. Annealing. Heat-treatment. Fettling. Finishing processes. Sand blasting, pickling, enamelling, galvanising, plating.

Foundry Metallurgy.—The metallurgy of cast iron and cast steel. Pure irons. Iron-carbon alloys. The iron-carbon diagram. The phase rule. Structural components. The influence of elements present and of alloy additions. Malleable cast iron, austenitic irons and steels. The influence of gases. Fluidity. Chill. Defects. Shrinkage and contraction. Physical properties. Mechanical properties at ordinary and elevated temperatures. Resistance to heat. Resistance to corrosion. Resistance to wear. Standard tests, British and foreign. Relationship of size of test-piece to size of casting. High-duty irons and steels.

The metallurgy of the non-ferrous metals. Composition, structure and properties at ordinary and elevated temperatures of the alloys of copper, tin, zinc, aluminium, nickel, magnesium. Brasses, bronzes, light alloys.

Laboratory

The object of the laboratory courses is not necessarily to enable students to carry out

(*Concluded on page* 20.)

XUM

TRADE SIROCCO MARK

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The "Sirocco" Dust Collecting Plant illustrated is considered by local authorities a model of excellence.

Full particulars and drawings have been called for to serve as a criterion for future requirements in other factories. This standard is maintained throughout the range of manufactures comprising "Sirocco Products."

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XUM

This Week's News in Brief

Trade Talk

MESSRS. BARTON & SONS (1935), LIMITED, manufacturers of malleable-iron castings, originally established in 1890, are issuing at par 340,000 ordinary shares of 5s. each.

THE STEEL COMPANY OF SCOTLAND, LIMITED, Blochairn Works, Glasgow, has booked an order for 400 tyres for railway carriages and wagons for the Assam Bengal Railway Company.

GENERAL REFRACTORIES, LIMITED, announces that the issue to shareholders of 100,000 shares of 10s. each at the price of 18s. 6d. per share in a proportion of one to five has been over-subscribed.

THE NEW depôt ship "Woolwich," built by the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow, for the British Admiralty, has carried out successful acceptance trials on the Clyde.

MODERNISATION OF THE rolling mills at the Britannia Works of Messrs. Dorman, Long & Company, Limited, Middlesbrough, is to be undertaken, and a contract, it is learned, has been placed with the General Electric Company, Limited.

THE DEPARTMENT OF OVERSEAS TRADE announce that within 10 days of the issue of application forms for space in the British Industries Fair in February, 1936, 309 manufacturers have asked for a total area of 151,412 sq. ft. of space, compared with the 241 applications for 96,140 sq. ft. at the corresponding date a year ago.

MESSRS. TH. TEISEN, 20A, Temple Street, Birmingham, 2, are constructing a large enamelling plant in Ireland for the hollow-ware trade. The furnaces are their patent recuperative producer gas-fired muffles, high-power type, such as are being used successfully by several large firms in the Birmingham area and elsewhere.

THE MEMBERS of the Workington Iron & Steel Company's Social Organisation recently witnessed the formal opening of the Organisation's hard tennis courts by Mrs. Crichton, the wife of the director and general manager of the Cumberland branches of the United Steel Companies, Limited. These courts have been put down by the Social Organisation and have cost approximately £330. The money was found out of the members' subscriptions of 1d. per week.

A PERMANENT EXHIBIT of metals and plastics will be opened by Metal Products Exhibits, Inc., on September 1, at Rockefeller Centre, New York. The exhibition will be devoted wholly to the interests of those who specify and purchase materials and parts for industrial purposes. It will feature alloys, ferrous and non-ferrous metals, plastics, finished and semi-finished parts made from these materials, finishes for metals and plastics, manufacturing processes, designs, styling, etc.

THE HUNSLET ENGINE COMPANY, LIMITED, Leeds, have purchased the entire goodwill, including patterns, drawings, etc., of the Avonside Engine Company, Limited, of Bristol, from the liquidator of that company. The Hunslet Engine Company, Limited, will in future conduct the business of the Avonside Company at their own works in Leeds, and will continue the valuable connection of the company both at home and abroad. It will be recalled that the Hunslet Engine Company similarly acquired the business of Kerr, Stuart & Company, Limited, of Stoke-on-Trent.

THE ENGLISH ELECTRIC COMPANY, LIMITED, have received a contract from the Air Ministry for complete power-station equipment, comprising four 875-b.h.p. seven-cylinder mechanical-injection, four-stroke cycle Diesel engines directly coupled to alternators, and complete with high- and low-tension switchgear, transformers and test-pond equipment. Included in the contract are spray coolers for the engine circulating water, fuel-oil separators, lubricating-oil filters, exhaust waste-heat boilers and other accessories associated with a complete generating station. The installation is for the Air Ministry's new station at Dhibban, Iraq.

RUBERY, OWEN & COMPANY, constructional engineers and manufacturers, of Darlaston, South Staffordshire, announce that the assets of the firm have been transferred to a private limited company, which will trade as from July 1, 1935, under the title of Rubery, Owen & Company, Limited, with Mr. A. G. B. Owen as chairman and managing director. The constitution of the limited company will be fundamentally that of the firm, as the four trustees of the late Mr. A. E. Owen become directors, with the addition of Mr. E. W. B. Owen. It will therefore continue a family business, and there are no outside interests. There will be no mortgage debenture or charge of any kind on the company's assets. In carrying out this arrangement, the trustees are following a direction of the will of the late Mr. A. E. Owen. The business will be run on exactly the same lines as heretofore, and under the same management, and there should be no noticeable change.

Company Reports

Callender's Cable & Construction Company, Limited.—Net profit, £236,729; brought in, £294,231; dividend on the ordinary shares of 15 per cent.; carried forward, £306,372.

John Harper & Company, Limited.—Profit, £17,250; brought in, £5,000; dividend of 9 per cent. and excess dividend on employees' preference shares of 2 per cent.; carried forward, £5,938.

Allied Ironfounders, Limited.—Gross trading profits of the subsidiary companies, £326,530; total income, £372,561; to research and development account, £30,000; to general reserve, £60,000; brought in, £102,674; carried forward, £124,767. A profit of £47,621 on the conversion of income debenture stock has been transferred to central obsolescence and depreciation reserve and the remainder of the debenture redemption reserve (£15,198) has also been transferred to that account.

John Hetherington (Holdings), Limited.—Loss for year, after making allowance for bad and doubtful debts and crediting transfer fees, etc., £1,370; debit balance brought in, £152,834; total debit, £154,204. The outstanding change in the balance sheet this year as compared with last is the reduction of the overdraft from £103,163 to £210 by the sale of investments. As a consequence of this transaction the loss for the year has been reduced from £7,265 to £1,370. The latter amount consists mainly of bank interest, which will undergo still further reduction in the next year.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Denman, Hart & Company, Limited, 56, Kingsway, W.C.2.—Capital £2,000. General engineers, metal workers, etc. Directors: J. F. Denman and V. Hart.

Forge Craft (Wood Green), Limited, 38, Crawley Road, N.22.—Capital £1,000. Manufacturers of ferrous and non-ferrous metals. Directors: H. Johnson, C. Johnson, and G. Johnson.

W. A. & H. J. Hancock, Limited.—Capital £500. Precision, electrical, hydraulic and general engineers. Directors: W. A. Hancock, "St. Feock," 13, Shepherds Road, Watford; H. J. Hancock.

Electro-Alloys, Limited.—Capital £10,000. To carry on the business of manufacturing and treating by electrolytic and other means tungsten and other metals and substances. Directors: L. Goldschmidt, 54, Victoria Street, S.W.1.; M. A. Halle, and R. M. Postlethwaite.

Contracts Open

Cholsey, July 24.—Pumping plant, for the Wallingford Rural District Council. Messrs. Fiddian & Deeley, 13, Church Street, Stourbridge. (Fee £2 2s., returnable.)

Steeple Bumpstead, July 11.—Supplying and laying 8,232 yds. of 3-in. cast-iron water main, with all necessary bends, valves, etc., for the Halstead Rural District Council. Mr. H. B. Thake, 10, High Street, Haverhill, Suffolk. (Fee £2 2s., returnable.)

Ruthin, July 9.—Supply and delivery of 890 yds. of 5-in. dia. and 3,700 yds. of 3-in. dia. spun-iron pipes, with bends, specials, etc., for the Rural District Council. Messrs. Sandford, Fawcett & Partners, 53, Victoria Street, Westminster, S.W.1. (Fee £2 2s., returnable.)

Personal

ON THE OCCASION of his approaching marriage, Mr. George Gillespie was presented last week with a wallet of notes by the staff of the brass foundry of Carron Company. Mr. James Shearer presided, and Mr. Andrew Scotland, the oldest workman, expressed the good wishes of his colleagues.

MR. WILLIAM LOGAN, who has been a director of Messrs. Bairds & Dalmellington, Limited, since the formation of the company, has resigned from the directorate as from June 30, on taking up an appointment as managing director with Messrs. William Baird & Company, Limited, Coatbridge.

THE IRON AND STEEL TRADES CONFEDERATION has appointed Mr. James Sweeney, of Darlington, as Scottish secretary, in succession to Mr. John Brown, who has been elected general secretary in London. He will commence his duties in August, and he will have the assistance of Bailie William Smart, of Motherwell, who was recently appointed organiser for the West of Scotland.

MR. H. G. JUDD, C.B.E., is a member of the advisory committee appointed by the Secretary of State for Air to watch the public interest in regard to the prices to be paid for aircraft supplies. Mr. Judd, who is, of course, secretary of the National Ironfounding Employers' Association, was during the war Director of Contract Finance and Deputy Controller of Contracts for the Ministry of Munitions. He is a member of the firm of Mann, Judd, Gordon & Company, chartered accountants, of London, Glasgow and Newcastle-upon-Tyne.

SIR SAMUEL ROBERTS, BT., M.P. for Ecclesall, Sheffield, has decided not to seek re-election after this Parliament has dissolved. Sir Samuel is chairman of Messrs. Newton, Chambers & Company, Limited, the Wombwell Coke & By-products Company, Limited, and the Wombwell Main Company, Limited, and a director of Thorncliffe Coal Distillation, Limited, the British Wagon Company, Limited, and other companies. In a letter conveying his decision, Sir Samuel points out that he has recently taken on new responsibilities in Sheffield and district. He is to be the next Master Cutler and hopes to continue to take an active part in the public life of Sheffield.

Will

KIDD, THOMAS STOCKTON, a director of John Kidd & Sons, iron and steel merchants, Chapel Street, Salford, Lancashire £8,566

Obituary

MR. JOHN HALBERT, who for about 50 years was on the staff of Messrs. Dalmellington Iron Company, Limited, latterly Bairds & Dalmellington, Limited, died recently. Mr. Halbert was on the point of retiring owing to ill-health.

MR. HOWARD COPPUCK LEVIS died at Biarritz recently, at the age of 76. Mr. Levis became managing director of the British Thomson-Houston Company, Limited, in February, 1902, and served in that capacity until October, 1916, when he became chairman. He took an active part in the fusion of the British Thomson-Houston Company with Associated Electrical Industries, Limited, of which he became chairman in October, 1928. He resigned from both boards in June, 1929.

MR. GEORGE HARLOW, manager of the plant sales department of the Metropolitan-Vickers Electrical Company, Limited, and also for some years director of the Metropolitan-Vickers Electrical Export Company, Limited, died on June 18. Mr. Harlow joined the Metropolitan-Vickers Company in 1903 as an apprentice, and was appointed to the staff in 1906, holding posts in the switchgear and transformer engineering and later in the plant and turbine sales departments. He spent a period of four years representing the company in Australia and three years in South America.

THE IMPORT DUTIES ADVISORY COMMITTEE announce that they have decided not to make any recommendation in respect of the application previously advertised for the addition to the free list of magnesium sulphate, and that the application previously advertised for an increase in the import duty on cast-iron porcelain enamelled baths has now been withdrawn.

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Raw Material Markets

The improvement in the markets recently reported is maintained, and the outlook may be considered to be encouraging. Pig-iron has had a better demand and two more hematite furnaces are expected to be restarted on the North-East Coast. The discussions between the British and Continental manufacturers relative to the division of export markets in iron and steel are believed to be advancing towards a conclusion that should prove beneficial to both parties, and this news has given additional confidence to the manufacturers.

Pig-Iron

MIDDLESBROUGH.—The fact that deliveries of Cleveland pig-iron have been below the normal tonnage during the last few weeks does not necessarily imply that the markets have weakened—the reason is that supplies have been scarce for the open market. This is mainly due to domestic consumption being exceptionally high. Owing to this relative scarcity, exports of pig-iron are very restricted. Prices for the home market are unchanged, being based on No. 3 Cleveland G.M.B. at 67s. 6d. per ton delivered Middlesbrough, 69s. 6d. delivered North-East Coast, 67s. 3d. delivered Falkirk, and 70s. 3d. delivered Glasgow.

Numerous inquiries are in circulation for East Coast hematite iron and, although the majority of these concern domestic needs, the merchants are trying to keep in contact with overseas buyers. Industrial prospects are encouraging, and in most works stocks have been reduced. In the near future two more hematite furnaces are to be relighted. The quotation for East Coast hematite No. 1 delivered Middlesbrough remains at 69s. per ton. The zone prices in other districts are:—North-East Coast, 71s.; Scotland, 75s.; Lancashire, 76s.; Yorkshire, 75s. to 78s.; South Staffordshire, 79s. per ton.

LANCASHIRE.—New orders are not too frequent in this area, but the works are being kept busy meeting the contracts which they have already for delivery to Lancashire foundries. Sellers seem to be fairly well satisfied with the rate at which the iron is being taken up. From the Manchester and West Yorkshire areas come reports that the majority of machine-tool manufacturers continue to be fairly well employed. Only moderate activity is reported in the textile-machinery trade, while the heavy electrical engineering branch reports that conditions are steady. Offers of Staffordshire, Derbyshire, and Lancashire brands of No. 3 iron equal to Derbyshire, for delivery in the Lancashire price zone are all at 74s. per ton. Northamptonshire is at 72s. 6d. and Derbyshire forge iron at 69s. to 70s.

MIDLANDS.—The manufacturers of light castings are still calling for pig-iron in fairly large quantities. Apart from this demand, there is an expanding outlet in other directions. The controlled prices, which remain unaltered, are 67s. 6d. per ton for Northants No. 3 and 71s. per ton for Derbyshire, Lincolnshire and North Staffordshire No. 3, including delivery to Birmingham and Black Country stations, and subject to a rebate to large consumers. Low-phosphorus iron ranges from 85s. to 90s. and medium-phosphorus from 72s. to 80s. Specially-refined iron varies from £5 7s. 6d. up to about £7 per ton delivered. The controlled price of East Coast hematite pig-iron remains at 78s. per ton delivered this area. Welsh hematite is also 78s., while West Coast No. 3 is 84s. 6d. per ton.

SCOTLAND.—Owing to the approach of the Glasgow Fair holidays the market is quieter and there is no change in pig-iron prices at 70s. f.o.t. furnaces for No. 3 foundry and 72s. 6d. for No. 1. Deliveries of pig-iron to the Falkirk foundries are suspended until after the holidays, which began this week and will last for ten or fourteen days. Cleveland No. 3 foundry iron is unchanged at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow. Quotations for other English foundry irons are 1s. 3d. below these figures.

Coke

New business in the foundry-coke market is very quiet except for small orders. Welsh foundry coke prices have eased. For delivery in the Birmingham and Black Country area Durham foundry coke is quoted from 34s. to 40s., and Welsh from 31s. to 42s. 6d., according to analysis. Limited supplies of Scottish low-ash coke are sold at about 40s. per ton delivered Birmingham.

Steel

Satisfactory conditions continue to rule in the steel market, and there is a noticeable tendency for business in most departments to expand, states the official report of the London Iron and Steel Exchange. With the approach of the holiday season, business may be expected to decline, but the tonnage of orders carried by the steelworks should be sufficient to ensure active working for the next few months. The busy conditions which recently developed in the semi-finished steel department have been maintained, and in the absence of any offers of Continental material practically all market requirements have been met by British producers. Consumers' requirements tend to increase, and, although considerable stocks are held by users, a large volume of new business has been reaching the steelworks. The demand for finished steel is steady and the works in most departments are making good deliveries against current contracts. In some branches there has been a lull in new business which, in view of the strong buying in recent weeks, was only to be expected.

Scrap

In the Cleveland area the price of machinery cast-iron scrap has eased and prices range from 54s. to 55s. per ton delivered. A moderate demand for foundry cast-iron scrap at 52s. 6d. is reported. The highest price obtainable for light iron is 42s. 6d. per ton, and the price of cast-iron borings is nominally unchanged at 25s. per ton. A good demand for scrap prevails in the Midland district and prices are inclined to rise. Heavy machinery metal in handy sizes is offered at 55s. to 57s. 6d., good heavy scrap at 50s., and clean light metal at 47s. 6d. Clear cast-iron borings are at 30s., all delivered works. In South Wales, heavy cast-iron scrap is at 50s. to 52s., and good cast-iron scrap in cupola sizes is from 52s. 6d. to 55s. Very little business has been done and the majority of orders are only small. In Yorkshire, the market is firm and foundry heavy cast iron is active at up to 55s. delivered. Light cast iron is from 42s. to 43s. and steelworks' heavy cast iron is at 50s. delivered.

Metals

Copper.—Consumption has been satisfactorily maintained, but buying is quiet and inconsistent. In view of the unsettled conditions in America, the price on the London market has been quite well upheld. Much depends on the way the situation develops on the other side of the Atlantic. Following competitive offers which arose after the Supreme Court's decision in respect to code matters, the producers last week reduced their price to 8 cents. Whether this new price will be held remains to be seen. A lower level is thought in some quarters to be possible. On the other hand, it is argued that many orders were held up pending a clarification of the position, and that these should be absorbed at the new rate and should account in addition for much of the current production. It may be, therefore, that not a great deal of metal will become available for export.

Daily market prices:—

Cash.—Thursday, £28 15s. to £28 16s. 3d.; Friday, £28 17s. 6d. to £29; Monday, £29 5s. to £29 7s. 6d.; Tuesday, £30 2s. 6d. to £30 3s. 9d.; Wednesday, £30 7s. 6d. to £30 8s. 9d.

Three Months.—Thursday, £29 3s. 9d. to £29 5s.; Friday, £29 6s. 3d. to £29 7s. 6d.; Monday, £29 13s. 9d. to £29 16s. 3d.; Tuesday, £30 10s. to £30 11s. 3d.; Wednesday, £30 15s. to £30 16s. 3d.

Tin.—Prices of this metal have remained very steady throughout the week, and the position as a whole shows little change. Demand from consumers remains on a moderate scale, both in this country and on the Continent. June statistics made a favourable showing. According to Mr. W. H. Gartsen, the total visible supply at June 30 was 13,355 tons, against 15,831 tons, a reduction of 2,476 tons. The carry-over in the Straits decreased 434 tons to 842 tons. There was an increase of 24 tons at the Arnhem (Holland) smelter, making a total reduction in supplies in sight at the end of June of 2,886 tons.

Day-to-day fluctuations:—

Cash.—Thursday, £229 17s. 6d. to £230; Friday, £229 17s. 6d. to £230; Monday, £229 17s. 6d. to £230; Tuesday, £229 15s. to £229 17s. 6d.; Wednesday, £230 5s. to £230 10s.

Three Months.—Thursday, £220 10s. to £220 12s. 6d.; Friday, £220 15s. to £221 5s.; Monday, £222 7s. 6d. to £222 10s.; Tuesday, £225 2s. 6d. to £225 5s.; Wednesday, £225 12s. 6d. to £225 15s.

Spelter.—Steady conditions have ruled in this metal also. Buying, if not active, is moderately good. The market is awaiting a definite announcement concerning the British import duty, to which a reference was made in Parliament this week.

Official quotations were as follow:—

Ordinary.—Thursday, £13 17s. 6d.; Friday, £14; Monday, £13 16s. 3d.; Tuesday, £13 17s. 6d.; Wednesday, £13 17s. 6d.

Lead.—Demand for this metal remains good, and prospects are regarded as favourable. It is understood that the Import Duties Advisory Committee has definitely approved of certain changes in the import duty, both on this metal and on spelter, and an official announcement is expected shortly. Reference to this matter was made by the Chancellor of the Exchequer in the House of Commons on Monday, when in seeking power through a clause in the Finance Bill to charge an import duty of less than 10 per cent. *ad valorem* in exceptional cases, he explained that the Import Duties Advisory Committee, which had been invited to consider the difficulties which had arisen regarding the formula for imported lead and zinc arrived at at the Ottawa Conference, had intimated that it would probably find a solution on the basis of a duty of less than 10 per cent. on the foreign product.

Day-to-day quotations:—

Soft Foreign (Prompt).—Thursday, £13 13s. 9d.; Friday, £13 15s.; Monday, £13 11s. 3d.; Tuesday, £13 17s. 6d.; Wednesday, £13 16s. 3d.

British Foundry School

(*Concluded from page* 16.)

analyses and examinations on a commercial basis, but rather to familiarise them with the operations that go on, in order to provide a basis for the interpretation of microstructures, chemical analyses and mechanical tests needed in everyday foundry operation. In particular the limitations of each of these laboratory methods of approach will be indicated. Laboratory work will include the following.

Metallographical Laboratory.—The preparation and polishing of samples for examination of unetched and etched structures. Micro and macro structures. The interpretation of photomicrographs. Components of structure in ferrous and non-ferrous castings. The study of inclusions. Porosity and openness.

Chemical Laboratory.—The preparation of samples of cast ferrous and non-ferrous metals for chemical analysis and the qualitative and quantitative determination of elements present. The calculation of compounds actually present. The examination of foundry blackings, facings, fuels, sands, refractories, slags.

Sands and Refractories Laboratory.—Moulding and core sands and foundry refractories. Standard tests on moulding sands, core sands, coal dusts, blackings and facings. Tests on green sand, dry sand and loam. Oil-sand cores.

Mechanical Testing Laboratory.—Tensile and transverse tests. Elongation and deflection. Compression. Hardness. Impact. Band tests. Testing small pieces. Tests at elevated temperatures. Wear and corrosion tests.

Physical Laboratory.—Physical properties, thermal, electrical magnetic, etc.

Foundry.—Fluidity and chill tests. Expansion and contraction. Soundness.

Engineering Drawing.—Sketching. Drawing. Reading a drawing. Casting design.

Further information and forms of application for admission may be obtained from the Secretary to the Governing Body or the Principal of the College, at the British Foundry School, Central Technical College, Birmingham 1, or from the Hon. Adviser to the Governing Body, Mr. J. G. Pearce, 21, St. Paul's Square, Birmingham 3.

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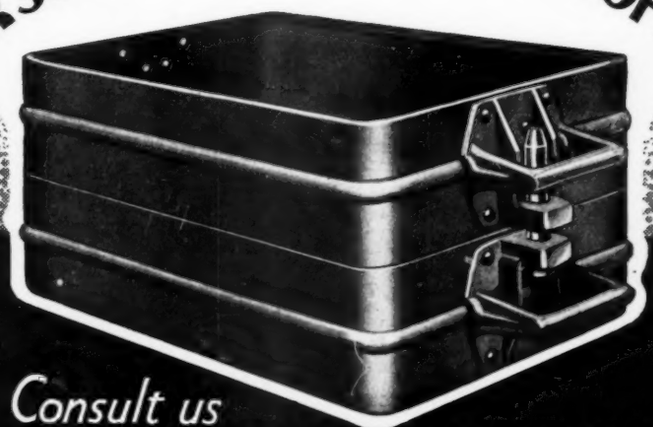

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STERLING FOUNDRY SPECIALTIES LTD
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RAW MATERIALS—PRICE LIST

(Wednesday, July 3, 1935)

COPPER

	£	s.	d.
Standard cash	30	7	6
Three months	30	15	0
Electrolytic	33	15	0
Tough	31	15	0
Best selected	32	5	0
Sheets	62	0	0
India	43	5	0
Wire bars	33	15	0
Ingot bars	33	15	0
H.C. wire rods	37	10	0
Off. av. cash, June	30	16	8 1/16
Do., 3 mths., June	31	4	1 1/16
Do., Sttlmnt., June	30	16	10 3/16
Do., Electro, June	34	7	4 15/16
Do., B.S., June	33	13	1 1/2
Do., wire bars, June	34	13	11 7/16
Solid drawn tubes			9 3/4d.
Brazed tubes			9 3/4d.
Wire			6 1/2d.

BRASS

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8d.
Rods, extd. or rlld.	4 1/2d.
Sheets to 10 w.g.	7 1/2d.
Wire	7 1/2d.
Rolled metal	6 7/8d.
Yellow metal rods	4 1/2d.
Do. 4 × 4 Squares	5 1/2d.
Do. 4 × 3 Sheets	5 1/2d.

TIN

	£	s.	d.
Standard cash	230	5	0
Three months	225	12	6
English	230	5	0
Bars	232	5	0
Straits (nom.)	239	5	0
Australian (nom.)			—
Eastern	230	2	6
Banca (nom.)	237	5	0
Off. av. cash, June	227	14	3 6/16
Do., 3 mths., June	219	10	9 9/16
Do., Sttlmt., June	227	14	5 13/16

SPELTER

	£	s.	d.
Ordinary	13	17	6
Remelted	14	10	0
Hard	11	15	0
Electro 99.9	16	10	0
English	14	17	6
India	11	15	0
Zinc dust	18	10	0
Zinc ashes	3	5	0
Off. aver., June	13	16	3 1/16
Aver. spot, June	13	14	8 1/16

LEAD

	£	s.	d.
Soft foreign ppt.	13	16	3
Empire (nom.)	15	0	0
English	15	15	0
Off. average, June	13	15	9 13/16
Average spot, June	13	15	6 9/16

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	0	0
Do., V.M. ex-whse.	23	12	6
Rods	28	15	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	76	0	0	to	77	0	0
Chinese, ex-whse.					70	0	0
Crude, c.i.f.					25	5	0

QUICKSILVER

Quicksilver	11	2	6	to	11	12	6

FERRO-ALLOYS AND STEEL-MAKING METALS

	£	s.	d.
Ferro-silicon—			
25%	8	17	6
45/50%	12	15	0
75%	17	17	6
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	4/6 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£15	15	0
Ferro-tungsten—			
80/85%	3/- lb.		
Tungsten metal powder—			
98/99%	3/3 lb.		
Ferro-chrome—			
2/4% car.	33	10	0
4/6% car.	21	15	0
6/8% car.	21	0	0
8/10% car.	21	0	0
Ferro-chrome—			
Max. 2% car.	34	0	0
Max. 1% car.	36	5	0
Max. 0.70% car.	37	5	0
70% carbon-free	9 1/4d. lb.		
Nickel—99.5/100%	£200 to £205		
"F" nickel shot	£184	0	0
Ferro-cobalt, 98/99%	5/6 lb.		
Metallic chromium—			
96/98%	2/5 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11	5	0
76/80% packed	£11 15 0 to £12	5	0
76/80% export	(nom.) £9	15	0
Metallic manganese—			
94/96% carbon-free	1/3 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under 1/2 in. to 1/4 in.	3d. lb.
Do., under 1/4 in. to 3/16 in.	1/- lb.
Flats, 1/2 in. × 1/4 in. to under 1 in. × 1/2 in.	3d. lb.
Do., under 1/4 in. × 1/4 in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£	s.	d.		£	s.	d.
Heavy steel	2	15	0	to	2	16	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to	2	11	6
Heavy cast iron	2	10	0	to	2	12	0
Good machinery	2	12	6	to	2	15	0
Cleveland—							
Heavy steel					2	12	6
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy cast iron					2	12	6
Heavy machinery	2	14	0	to	2	15	0
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					2	17	6
Steel turnings					1	14	0
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	12	6
Engineers' turnings					1	19	6
Cast-iron borings	1	17	6	to	1	19	0
Wrot-iron piling					2	17	6
Heavy machinery					2	17	0

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	26	0	0
Brass	17	0	0
Lead (less usual draft)	12	10	0
Tea lead	9	10	0
Zinc	8	10	0
New aluminium cuttings	66	0	0
Braziery copper	22	0	0
Gunmetal	24	0	0
Hollow pewter	155	0	0
Shaped black pewter	110	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d/d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/-
Clyde, No. 3	82/-
Monkland, No. 3	82/-
Summerlee, No. 3	82/-
Eglinton, No. 3	82/-
Gartsherrie, No. 3	82/-
Shotts, No. 3	82/-

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to	9	15	0
Nut and bolt iron	7	10	0	to	8	0	0
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.			12	0	0		
Gas strip	10	10	0	and up.			
Bolts and nuts, 3/4 in. × 4 in.	14	2	6	and up.			
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	9	5	0	to	9	7	6
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5 1/2 in.					9	7	6
Rounds under 3 in. to 1/4 in. (Untested)					8	12	0
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates	12	5	0	to	12	10	0
Hoops (Staffs)					9	7	0
Black sheets, 24g. (4-t. lots)					10	10	0
Galv. cor. shts. (,,)					13	0	0
Galv. flat shts. (,,)					13	10	0
Galv. fencing wire, 8g. plain					14	10	0
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to	7	2	6
Sheet bars	5	5	0	to	5	10	0
Tin bars	5	5	0	to	5	10	0

PHOSPHOR BRONZE

	Per lb. basis.
Strip	9 1/2d.
Sheet to 10 w.g.	11 1/2d.
Wire	11 1/2d.
Rods	11d.
Tubes	13 1/2d.
Castings	12d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1 1/2 to 1/7 1/2
To 15 in. wide	1/1 1/2 to 1/7 1/2
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2 1/2 to 1/8 1/2
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3 1/2
Ingots rolled to spoon size	10d. to 1/6 1/2
Wire round—	
to 10g.	1/4 1/2 to 1/11 1/2

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3 1/2 upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.31
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37 1/2
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	19/- to 22/-
,, furnace	16/6 to 17/9
Scotland, foundry	28/-
,, furnace	25/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20 × 14 per box		18/2 to 19/2
,,	28 × 20 ,,		36/4 to 38/4
,,	20 × 10 ,,		26/-
,,	18 3/4 × 14 ,,		18/9
C.W.	20 × 14 ,,		15/3 to 15/6
,,	28 × 20 ,,		32/6 to 33/-
,,	20 × 10 ,,		23/- to 23/3
,,	18 3/4 × 14 ,,		15/6 to 15/9

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
June 27 ..	28	15	0	dec.	10/-
„ 28 ..	28	17	6	inc.	2/6
July 1 ..	29	5	0	„	7/6
„ 2 ..	30	2	6	„	17/6
„ 3 ..	30	7	6	„	5/-

Electrolytic Copper

	£	s.	d.		
June 27 ..	32	0	0	dec.	10/-
„ 28 ..	32	0	0	No	change
July 1 ..	32	10	0	inc.	10/-
„ 2 ..	32	15	0	„	5/-
„ 3 ..	33	15	0	„	20/-

Standard Tin (cash)

	£	s.	d.		
June 27 ..	229	17	6	inc.	2/6
„ 28 ..	229	17	6	No	change
July 1 ..	229	17	6	„	„
„ 2 ..	229	15	0	dec.	2/6
„ 3 ..	230	5	0	inc.	10/-

Tin (English ingots)

	£	s.	d.		
June 27 ..	230	5	0	inc.	5/-
„ 28 ..	230	5	0	No	change
July 1 ..	230	0	0	dec.	5/-
„ 2 ..	229	15	0	„	5/-
„ 3 ..	230	5	0	inc.	10/-

Spelter (ordinary)

	£	s.	d.		
June 27 ..	13	17	6	No	change
„ 28 ..	14	0	0	inc.	2/6
July 1 ..	13	16	3	dec.	3/9
„ 2 ..	13	17	6	inc.	1/3
„ 3 ..	13	17	6	No	change

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
June 27 ..	16	7	6	No	change
„ 28 ..	16	10	0	inc.	2/6
July 1 ..	16	8	9	dec.	1/3
„ 2 ..	16	10	0	inc.	1/3
„ 3 ..	16	10	0	No	change

Zinc Sheets (English)

	£	s.	d.		
June 27 ..	22	16	3	dec.	3/9
„ 28 ..	23	0	0	inc.	3/9
July 1 ..	22	18	9	dec.	1/3
„ 2 ..	23	0	0	inc.	1/3
„ 3 ..	23	0	0	No	change

Lead (English)

	£	s.	d.		
June 27 ..	15	15	0	No	change
„ 28 ..	15	15	0	„	„
July 1 ..	15	15	0	„	„
„ 2 ..	15	15	0	„	„
„ 3 ..	15	15	0	„	„

AVERAGE MONTHLY PRICES OF STEEL BOILER PLATES IN ENGLAND

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1898	6 10 0	6 8 9	6 8 9	6 10 0	6 15 0	6 18 9	6 17 6	6 17 6	7 2 6	6 15 0	7 0 0	7 5 0	6 15 8½
1899	7 5 0	8 0 0	8 2 6	8 2 6	8 5 0	8 5 0	8 12 6	8 12 6	8 15 0	8 15 0	9 2 6	9 5 0	8 17 8½
1900	9 5 0	9 5 0	9 7 6	9 10 0	9 12 6	10 5 0	10 5 0	10 5 0	10 5 0	10 0 0	9 15 0	9 15 0	9 15 10
1901	9 5 0	9 5 0	8 15 0	8 10 0	8 10 0	7 10 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 3 11
1902	7 7 6	7 0 0	7 12 6	7 12 6	7 12 6	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 9 7
1903	7 10 0	7 10 0	7 15 0	7 5 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	6 17 6	7 3 11½
1904	6 12 6	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 11½
1905	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 10 0	7 5 0	8 0 0	8 0 0	7 1 3
1906	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 0 10
1907	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 8 4
1908	7 10 0	7 10 0	7 10 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 3 9
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 15 0	6 15 0	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 9
1910	7 0 0	7 0 0	7 1 3	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 10 0	7 10 0	7 10 0	7 5 1
1911	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 14 0	7 10 4
1912	7 18 9	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 15 0	8 16 3	9 0 0	9 2 0	9 5 0	8 11 2½
1913	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	8 19 0	8 15 0	8 5 0	7 15 0	7 15 0	8 17 0
1914	7 15 0	7 15 0	7 15 0	7 13 9	7 10 6	7 5 0	7 0 0	8 0 0	8 2 6	8 5 0	8 5 0	8 5 0	7 15 11½
1915	8 14 0	9 10 0	9 17 6	10 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 4 0	12 0 0	13 0 0	10 15 5½
1916	13 0 0	13 0 0	13 0 0	12 15 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 12 11
1917	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1918	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1919	13 0 0	15 0 0	15 0 0	15 0 0	19 5 0	19 17 6	21 0 0	21 10 0	21 10 0	21 10 0	21 15 0	23 10 0	18 9 9
1920	26 0 0	28 0 0	28 5 0	28 10 0	29 5 0	30 0 0	30 0 0	30 0 0	30 10 0	31 0 0	31 0 0	31 0 0	29 9 2
1921	30 5 0	29 0 0	25 0 0	25 0 0	25 0 0	23 0 0	21 0 0	20 10 0	19 0 0	17 10 0	16 0 0	14 16 0	22 1 9
1922	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 1 8	13 10 0	12 15 0	12 10 0	12 10 0	12 10 0	13 6 0	13 10 9
1923	12 8 9	13 6 0	14 0 0	14 0 0	14 0 0	13 12 6	13 0 0	13 0 0	13 0 0	13 0 0	13 0 0	13 10 0	13 0 11½
1924	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	14 0 0	14 0 0	13 11 0	13 5 0	13 5 0	13 10 11
1925	13 5 0	13 5 0	13 5 0	13 1 0	12 15 0	12 15 0	12 15 0	12 15 0	12 7 6	11 14 0	11 10 0	11 10 0	12 11 5½
1926	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 6 3
1927	11 5 0	11 5 0	11 5 0	11 5 0	11 2 6	11 0 0	11 0 0	11 0 0	10 16 0	10 10 0	10 10 0	10 10 0	10 19 0½
1928	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0
1929	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 5 0	10 1 3	10 1 3	10 1 3	10 1 7	10 6 8½
1930	10 2 9	10 3 5½	10 3 9	10 3 9	10 3 6	10 2 6	10 2 6	10 2 6	10 2 2½	9 19 6	9 16 3	9 16 3	10 1 6½
1931	9 15 0	9 15 0	9 15 0	9 10 11	9 6 9	9 5 0	9 7 0	9 7 9½	9 8 9	9 5 9	9 5 6	9 9 6	9 9 4
1932	9 5 0	9 2 6	8 18 6	8 17 6	8 16 6½	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 17 10
1933	8 10 0	8 10 0	8 10 0	8 8 9	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 6 0	8 7 6	8 6 10½
1934	8 8 1½	8 10 7½	8 16 6	8 17 6	8 6 3	8 6 3	8 5 7½	8 5 0	8 5 0	8 5 0	9 6 3	9 6 3	8 11 6½
1935	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	—	—	—	—	—	—	—	—

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THE UNIVERSITY OF SHEFFIELD.

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W. M. GIBBONS,
Registrar.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

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THE Proprietors of the Patent No. 226751 for "Improvements in or relating to Processes for Incorporating Manganese with Iron" are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to: HASELTINE LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

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'Phone: 287 SLOUGH

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406 OSBORN jolt rollover.
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T.B. 1 Tilghman sandblast barrel 30"×20".

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